ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXII. No. 3399. JANUARY 15, 1943 6d. WEEKLY

Standards by Consent

Allowing Scope for Development

ALTHOUGH it is largely to the diversity of individual ideas that progress is due, these can find their full scope, in an engineering sense, only within the framework of their appropriate industry. The electrical industry has been notably enriched in this way. The time comes, nevertheless, when the existence of a number of perhaps only slightly different designs for doing the same thing prevents the economic fulfilment of the demand for them. Then, but not till then, arises the need to select for survival those types that best serve the public needs or, in other words, to adopt standards.

There are two methods of securing such standardisation as may be desirable. The first is to seek to harmonise possibly conflicting views through discussion between manufacturers and users. By this means not only are individual experiences pooled, but also the interest and understanding support (in spirit as well as in letter) is ensured of those who have to give effect to the decisions.

Performance and Dimensions

This is the general principle on which the British Standards Institution works. Its activities in the main have lain in the co-ordination of practice in regard to performance, and with questions of nomenclature and symbols, but it has also coped to some extent with dimensional limits to secure interchangeability.

The B.S.I. might perhaps in future go further with advantage, as Lieut.-Col. K. Edgcumbe submitted in his recent I.E.E. paper—the first of a series relating to standardisation. How far it would be desirable for it to go in prescribing interchangeability, other than dimensional, and in furthering "concentration" (restricting the variety of products) raises questions that would require very full consideration in all their implications. Other matters for early attention in this respect include the electrification of new buildings and possibly the issue of modified Standard Specifications for export.

Hastening Slowly

The electrical industry has always shown itself wholesomely averse from uniformity for its own sake and also from hurrying into standardisation alongside any new technical developments—courses that tend to stifle progress. It is true that war conditions have tended to favour standardisation of another kind, since swift bulk production of munitions has been an urgent need and there has been the handicap of dispersed manufacturing plants. While as far as practicable standardisation has been achieved with the aid of B.S.S., old and new, the necessity for conformity with emergency requirements has not usually been compatible with the careful examination of the issues involved (not only material ones) over a long period that normally accompanies the preparation of standards appropriate to a large multiple industry. Because of the essential importance of

this aspect to long-term progress in industry, we welcome the recommendation of the Electrical Industry Committee of the Institution of Electrical Engineers that the policy of standardisation by consent shall be continued—a policy that has hitherto provided enough flexibility to allow scope for the development of new discoveries and inventions as they present themselves. It has also provided evidence of a remarkable readiness to co-operate within the industry itself. While some acceleration of procedure may be called for in certain cases, the test of experience has shown the fundamental principle of present methods to be sound.

Value and Price

ELECTRICITY supply tariffs fall short of what is needful if they do not give full weight to the consumer's point of view. Provided the overall costs of an undertaking are met, the predominant factor is the value to the consumer of any particular service as reflected in the price which he is prepared to pay for it. The basic principles of this aspect of tariff making are discussed by Mr. Bolton in this issue. The acceptable price varies widely with the service, and a two-part tariff (though the primary charge may be disguised) has the great virtue of flexibility in giving scope to the consumer's preference and hence tends to promote the greater use of electricity.

A European Grid

SOME months ago Colonel T. H. Minshall advocated in *The Times* the setting up of an international organisation to co-ordinate and develop the public utility services of Europe. The matter was raised again by a correspondent in our contemporary this week. He showed that a great measure of reorganisation has been imposed upon the occupied countries by the Germans and suggests that under different auspices, having regard to general, not merely German, well-being, this might provide a basis for more permanent arrangements. Electricity supply naturally takes an important place in the scheme.

Methods of Control

THE success of such a plan will depend upon national feeling after the war. Will their experiences convince the afflicted nations that friendly co-operation is imperative or will their release from servitude bring with it a surge of intensified nationalism? Co-ordination would mean the supersession of national prejudices by a European outlook. The correspondent cites the World Power Conference and the international bodies for the consideration of electricity production and distribution and high-voltage transmission as examples of co-operation. But these were essentially "study groups" and although their recommendations were respectfully received, they fell far short of the idea of control, which connotes enforcement of decisions. A body on the lines of our Central Electricity Board is suggested.

Inflation of Values

THE question of whether Stock Exchange prices have not reached an unwarrantably high level, is being debated. Judged by past experience of the extent to which deflation of values can proceed after a devastating war, the answer to the question is an emphatic affirmative. To-day's prices of investments, and of many speculative shares too, are the direct result of the Government's twin policy of cheap money and a closed capital market. The day will come when industry will be clamouring for capital. The scramble after the war will not be for stocks and shares, as is the case to-day, but for money with which to build, instead of to destroy. The subject is one that claims practical and level-headed consideration from every interested class in the community.

A Fight Against Odds

THE autobiography of W. T. Henley, which is concluded in the Christmas number of the "Henley Telegraph," is the old story of genius handicapped by lack of means. His mind produced practical ideas faster than he could obtain the backing for working them out and he had to pay dearly for financial accommodation. He ends his notes by describing the works which he had built up, saying :—"This establishment with proper monetary support, could hold its own against any other in the world, but I have been always endeavouring to do too much with inadequate means." The forthcoming of "proper monetary support" and continued hard work on the part of his successors has certainly confirmed his opinion.

Aid for the Red Cross

Combined Appeal of the Electrical Industries

Electrical men are already convinced of the importance of the work of the Red Cross and St. John organisation. The launching of this special appeal gives them an opportunity of expressing their appreciation in a practical way

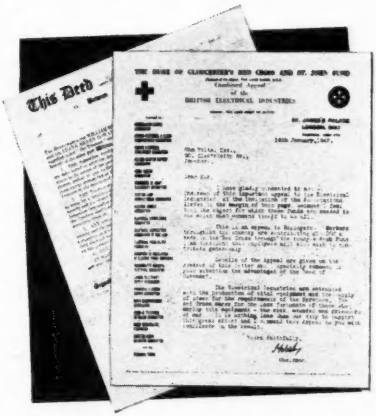
MANY of our great national industries have already responded to the appeal of H.R.H. the Duke of Gloucester for the Red Cross and St. John Fund by organising appeals within their industries with gratifying results.

It was felt that the electrical industries should take part in this scheme and an appeal is now being launched with the widest support of the Associations representing all branches of electrical activities, including electrical manufacturers, radio manufacturers, electricity supply undertakings, and wholesalers, contractors and retailers.

The following is the list of organisations participating in the Appeal :— Accumulator Makers' Association ; British Electrical and Allied Manufacturers' Association; British Electrical Development Association ; British Starter Battery Association ; Cable Makers' Association ; Conference of Joint Electricity Authorities ; Electric Lamp Manufacturers' Association ; Electric Vehicle Association ; Electrical Contractors' Association; E.C.A. of Scotland ; Electrical Wholesalers' Federation ; Incorporated Association of Electric Power Companies ; Incorporated Municipal Electrical Association ; London Electricity Supply Association ; Provincial Electric Supply Association ; Radio Manufacturers' Association; Radio and Television Retailers' Association; Radio Wholesalers' Federation; Scottish Radio Retailers' Association ; and the Technical Press.

At the joint invitation of the Associations Lord Hirst of Witton has consented to act as Chairman of the Appeal and a personal letter from Lord Hirst is now being sent out to all units of the industries. The initial working committee was formed under the chairmanship of Mr. V. Watlington, M.I.E.E. (Director of B.E.A.M.A.), with Mr. V. W. Dale (Business Manager of E.D.A.) and Mr. H. S. Pocock, M.I.E.E. (who initiated the Appeal) acting as Joint Secretaries.

Lord Hirst's letter is accompanied by a statement of the purpose and aims of the Appeal and particular attention is drawn to the advantages of entering into a covenant to subscribe annually for seven years *or the duration of the war*. By this means, whatever sum is contributed is doubled (at the present rate of income tax) because the Red Cross are able to recover the tax ; the gross amount is credited to the subscriber as his contribution. Single or occasional donations are, of course, welcome but they have not this special advantage and do not give the Red Cross the same assurance of a regular annual revenue. The official form of covenant is being sent with each appeal letter.



Lord Hirst's appeal letter and the deed of covenant form

In the course of his letter Lord Hirst says : " This is an appeal to employers. Workers throughout the country are contributing £50,000 a week to the Red Cross through the Penny-a-Week Fund. I am confident that employers will also wish to generously contribute. . . . . The electrical industries are entrusted with the production of vital equipment and the supply of power for the requirements of the Services. The Red Cross cares for the less fortunate of those who employ this equipment—the sick, wounded and prisoners of war. It is nothing less than our duty to support this great effort and I commend this Appeal to you with confidence in the result."

The enclosure of a form of covenant with the appeal letter makes the transaction a very simple one and we feel sure that the response of the great electrical industries will be worthy of them.

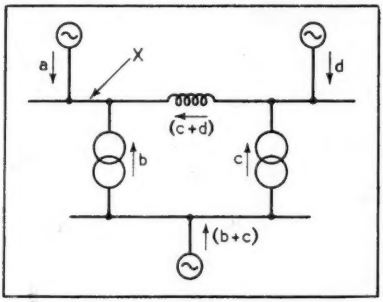
Short-Circuit Calculations

Reduction to a Common MVA Basis

By I.D.C.

THE following is a quick and convenient method of estimating short-circuit MVA in fairly complicated networks. It depends, as do all short-circuit calculations, upon the assumption of constant EMF at all sources of supply and zero EMF at the short-circuit, in which case the sum of voltage drops from any source to short-circuit *via* any route is the same.

The rules are: 1. Simplify the network by calculating the combined reactance of grouped units, *e.g.*, generators or transformers on one busbar. 2. Reduce all percentage reactance to a common MVA basis. 3. Multiply each percentage reactance by the MVA passing through it (usually unknown) and divide by 100. Then, considering any route through the network from power source to short-



circuit, the sum of these (reactance × MVA) products will be equal to the common MVA basis referred to in (2).

In this way several equations are obtained, one for each route through the network, the unknown in each case being the MVA along that route. When these equations are solved, the MVA at any particular point is obtained by adding the MVA from various routes.

In working out examples, stage 1 requires the reduction of groups of generators to equivalent single units and stage 2 the reduction of all reactances to a 50-MVA basis. (Reactance at 50 MVA = Reactance at × MVA × $\frac{50}{x}$). As an illustration, in the diagram, which shows the short-circuit at point X, the output of two 25-MVA generators is represented by (*a*) ; each has an inherent reactance of 12 per cent., which is equivalent to one 50-MVA generator with 12 per cent. reactance. A second source is (*d*), which relates to two 10-MVA generators each with 10 per cent. reactance and one 25-MVA generator with 12 per cent. reactance; this is equivalent to two 12-MVA and one 25-MVA generators, or to one 49-MVA generator, all with a 12 per cent. reactance, or to one of 50 MVA with a reactance of $12 \times \frac{50}{49} = 12{\cdot}25$ per cent. At (*b*) and (*c*) are two 10-MVA transformers, each with a reactance of 10 per cent., equivalent to two 50-MVA units having 50 per cent. reactances.

The sum of (*b*) and (*c*) is the output of a 30-MVA set with 20 per cent. reactance, which is equivalent to one 50-MVA unit with 33⅓ reactance. In the busbars between (*a*) and (*d*) is a reactance of 5 per cent. at 50 MVA.

In stage 3, calculate (*a*) directly: $a = 50 \times \frac{100}{12} = 416$ MVA. Then set up equations as follows:

$$\frac{12{\cdot}25}{100}d + \frac{5}{100}(c + d) = 50 \qquad \text{(i)}$$

$$\frac{33{\cdot}3}{100}(b + c) + \frac{50}{100}b = 50 \qquad \text{(ii)}$$

$$\frac{33{\cdot}3}{100}(b + c) + \frac{50}{100}c + \frac{5}{100}(c + d) = 50 \qquad \text{(iii)}$$

Solving (i), (ii) and (iii) gives $b = 52$, $c = 21$ and $d = 282$. Then short-circuit MVA at point $X = a + b + c + d = 416 + 52 + 21 + 282 = 771$.

Australian News

THE Commonwealth Government's powers have been extended to ensure that, in the interests of defence, the generation, transmission, distribution and supply of electricity are mobilised and co-ordinated. To this end regulations have been made for the appointment of a Controller of Electricity Supply and Regional Controllers may also be appointed for any control region. The Controller may recommend the supplementing of existing sources of electricity supply, removal of generating plant from one place to another, the regulation, restriction or prohibition of supply or consumption, the fixing of voltages, etc. In carrying out his powers he is required, so far as is practicable, to co-operate with persons carrying on existing undertakings. The Director-General of Munitions or the new Controller may enlarge the powers of the persons carrying on an undertaking. Any property other than land may be requisitioned.

The Sydney County Council has accepted the following tenders for the supply of 11,000-V metalclad switchgear in accordance with specification 615.—Australian General Electric Pty., Ltd. (62 panels at £19.882) and Westinghouse Rosebery Pty., Ltd. (38 panels at £13,196). *Tenders* (Melbourne).

A Modern Colliery

How Electricity Assists Output in a Gloucestershire Mine

While the public electricity supply in this country depends almost entirely upon coal, it is equally true that without electricity the output of coal from the mines would be reduced enormously. With the increased wartime demands for coal the assistance given by electricity assumes an especial importance

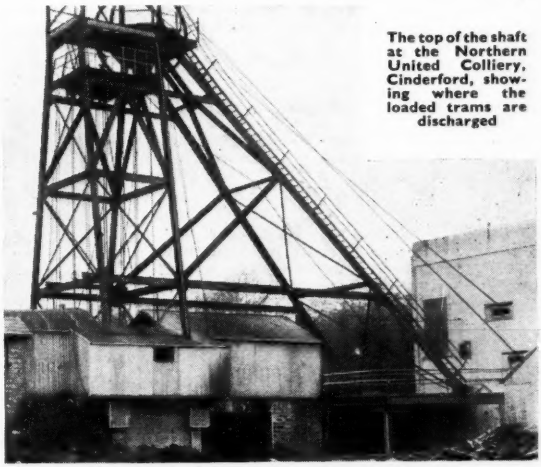
THE Forest of Dean in Gloucestershire has for centuries been famous as a coal producing area, and has not been behindhand in taking advantage of modern methods. We recently visited a very up-to-date Northern United Colliery at Cinderford belonging to Henry Crawshaw & Co., Ltd. Though not what might be described as a large mine, having an output of about 2,100 tons a week, it has been completely electrified with the most up-to-date equipment and is now well equipped to deal with the increased output that is anticipated as the work progresses.

Compared with mines in some other parts of the country, the Cinderford one is not very deep, the shaft being sunk only 232 yards. Following standard practice, the two cages which are used for carrying both men and coal are operated as a pair, one being raised as the other is lowered. The thick cable supporting them is wound round a 7 ft. diameter drum which is revolved by means of a 310-HP, 3,000-V, 580-RPM "Metrovick" slip-ring motor. Infinitely variable control of speed is obtained by means of a soda solution resistance inserted in the rotor circuit, while a standary Lilly hoist controller provides protection against overspeed as well as overwinding.

Independent of this controller there is also a mechanical system of control brought into use in the event of failure of the electricity supply. By the use of this latter control system it is possible to get the men out of the pit by balancing the cages, propping up the air brake and operating the foot brake. The compressor employed for the air brake is a 22 cu. ft. per minute Broom & Wade unit operated by a 15-HP, 950-RPM "Metrovick" motor. For this and the electric pneumatic reversing contractor incorporated in the Lilly controller a 400-V supply is furnished by a 15-kVA "Metrovick" transformer connected to the main 3,000-V supply.

A "Magnet" electrically operated indicator, somewhat similar in appearance to a ship's telegraph, shows the operator in charge at a glance which of the various operations is being carried out — "Raise," "Stop," "Lower," "Men In," "Raise Steady" and "Lower Steady," while by means of another device, comprising an indicator rising and falling on a worm wheel, he is kept informed of the position of the cages.

Signalling from top to bottom of the pit is done electrically, but in case of failure of the electricity supply a mechanical signal has been retained for communicating in the opposite directions. The time taken for a complete wind of the cages is 27 seconds, the average speed being therefore approximately 20 ft. per sec.



The top of the shaft at the Northern United Colliery, Cinderford, showing where the loaded trams are discharged

From the bottom of the shaft the workings have been carried sharply downwards to a depth of about 25 yd. (approximately 500 yd. below surface level) the slope at some places being as much as one in three. To haul the trams, each of which holds approximately 11 cwt. of coal, up this incline is obviously a difficult, if not impossible, task for ponies. Accordingly, while ponies are employed for the more level sections of the pit at the bottom, an electrical haulage system has been

provided to bring the trams, usually ten at a time, up the worst slope at a speed of about 6 MPH. Operating this haulage plant through a chain drive is a 200-HP, 3,000-V, 720-RPM Lancashire Dynamo slip-ring motor equipped with " Metrovick " circuit-breaker, drum controller and oil contactor reversing gear. The trams are returned to the coal face by gravity. In addition to this main haulage system there is a secondary plant, driven by a 15-HP, 750 RPM motor, serving the portion of the mine which is nearest to the main working.

Coal Cutting Equipment

Seven Austin Hopkinson " Black Star 50 " cutters are utilised for hewing the coal and these are driven by built-in 38-HP, 500-RPM motors. The hewn coal is carried by means of shaker conveyors (Mining Engineer Co.'s " E.12 ") for loading on to the trams. Each of these conveyors, of which there are five up to 80 yd. long available, has a 12-HP, 500-RPM motor incorporated with direct-on-line starter. A 17 to 1 speed reduction is secured through a crankshaft which is arranged to give a variable stroke of from 2½ to 5 in. The connecting rod on the end is fitted with a spring cushion to absorb any shock.

For pumping out water from the bottom of the shaft to the top two Pulsometer and Mather & Platt centrifugal pumps have been installed, each having a capacity of 750 gal. per min. against a head of 800 ft. These are driven by 220-HP, 3,000-V Greenwood & Batley motors running at 500 RPM. The water is brought to the level of the bottom of the shaft by means of two Sulzer centrifugal pumps with a capacity of 240 gal. per min. against a head of 820 ft. For operating these 120-HP, 3,000-V Crompton Parkinson and Siemens motors are used. In addition there is a Drysdale " Snorer " pump with a 15-HP, 400-V motor for keeping water out of the main working.

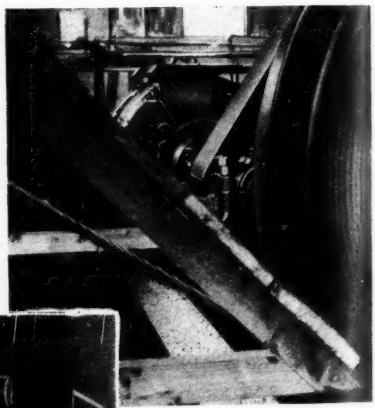
Similarly serving the communicating pit there is an electric winding engine driven by a 220-HP, 3,000-V, 580-RPM Westinghouse motor, and two centrifugal pumps (700 gal per min. against a head of 500 ft. and driven by 150-HP, 3,000-V, 500-RPM E.C.C. and Mather & Platt motors). This pit is also equipped with a haulage plant operated by a 155-HP, 3,000-V, 580-RPM Brush motor, while for ventilation there is a 50-HP " Sirocco " 91-in. diameter double-inlet fan working at about one-third load to allow for developments, driven by 55-HP, 3,300-V, 720-RPM Crompton motors.

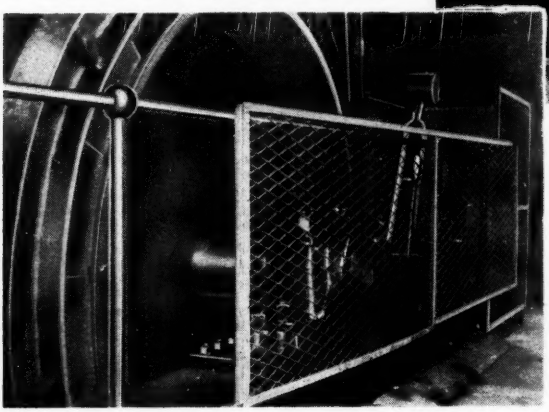
The fan, coal cutters, shaker conveyors and the smaller pumps are operated from a 400-V, three-phase supply provided by three 200-kVA Ferranti and B.T.H. transformers on the main 3,000-V, three-phase, 50-cycle supply.

Cable System

For the high-voltage circuits 0·1 sq. in. paper-insulated lead-covered double - armoured cable is arranged in 200-yd. lengths with B.I. plug type boxes connecting each section. The cables for the cutters, conveyors, etc., are 0·03 sq. in. v.i.r., Ellison gate-end connecting boxes being used.

As the atmosphere in the mines in this part of the country is non-inflammable, portable naked acetylene

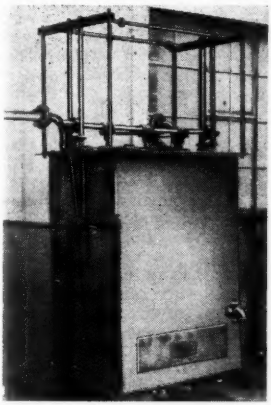


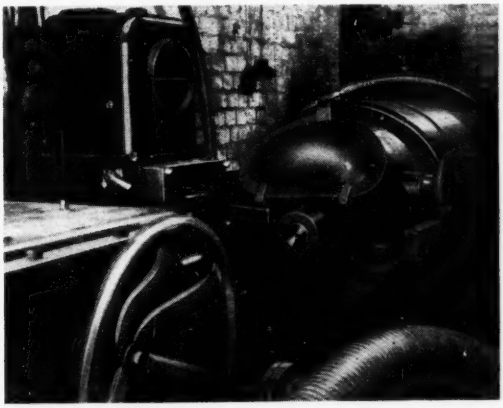


Left: Portion of the cage winding gear showing (with above) the mechanism for guarding against overload and overspeed

lamps are mainly employed for the purpose of illumination, though electric lamps have been provided in positions where permanent lighting is required.

We should like to thank the proprietors of the colliery for permitting us to inspect their plant, and also Mr. E. Gerrard, the manager, and Mr. W. G. Young, the chief engineer, for their assistance in the preparation of this article.





Left: The liquid controller for securing infinitely variable speed for the motor which raises and lowers the cages. Right: One of the large pumps employed for keeping the pit free from water.

Industrial Safety

Power Press Guards

A RECENT issue of the *Industrial Accident Prevention Bulletin*, produced by the Royal Society for the Prevention of Accidents and published by the Ministry of Labour and National Service, again calls attention to the dangers lurking in improperly guarded power presses which are one of the principal causes of industrial accidents.

It is said that probably more care and thought have been expended in the effort to devise effective guards for the tools of power presses than for any other machine used in industry. In this connection the automatic principle has strongly appealed to the power press users, and this explains why such a large number of clever automatic guards have been introduced for these machines. But unfortunately very many of these automatic guards have proved to be failures; they have satisfied neither the needs of accident prevention nor the legal requirements.

The opinion is expressed that by the exercise of sufficient ingenuity there is no press job which could not be arranged to be performed in a way permitting of the use of a fixed guard. Many jobs are done to-day with automatic guards which could and should be performed with fixed guards.

Motor Starter as Inching Device

Investigation of an accident which occurred in a large factory showed that men had been allowed to approach shafting while at rest for the purpose of belt mounting and while holding the belt on the pulley another person had used a motor-starter as an "inching" device. Although the use of a proper inching device is not only legal but also safe, the use of a motor-starter for inching purposes is both illegal and dangerous. The movement of the shaft cannot be properly controlled, and even if it only makes one revolution is likely to cause an accident. In the case investigated, the man's arm was caught between the belt and pulley and he was thrown over the shaft. Had the boy who was operating the starter lost his head and moved the starter forwards instead of backwards a fatal accident might have occurred, as the shaft was only a foot below the ceiling of the room.

Glasses for Welders

The *Bulletin* says that there appears to be an increasing demand for welders' blue glass. Such glass gives practically no protection against the real hazards of welding. A welding glass must serve two purposes; it must reduce glare to enable a man to see his job clearly, and secondly it must absorb the potentially harmful infra-red and ultra-violet rays. Welders' blue cuts the glare down but transmits 43 per cent. infra-red and 80 per cent. ultra-violet.

B.S.S.679 welders' glass should be used for all types of welding if trouble with the eyes is to be avoided. It is supplied in five shades or densities of tint, namely, A, B, C, D and E. It is green in tint, cool and pleasant in use and gives good definition. It affords complete absorption of the harmful rays.

Maintenance Problems

Criticisms by a Factory Electrician

By H. Yeomans

AFTER twenty-five years in the electrical industry, one finds still in use in factories a surprisingly large number of methods that have been a source of annoyance for the past generation, the chief one being poor accessibility and lack of standardisation. Sometimes it would appear to be almost analogous to the situation if our railway systems were made up of different gauges, and a station had to be moved to replace a bolt in the metals, only to find that the latter was of a peculiar design and entailed delay to obtain another. Yet an electrical system is essentially a form of transport carrying energy to wherever it is required.

A most important need is adherence to definite standards for the size, weight, current-carrying capacity and fixing arrangement of all accessories embodying moving contacts. Credit is due to manufacturers who have put on the market good competitive ranges of switchgear, but the latter has been abused by its use in places where heavy-duty types are required. By the introduction of a good standard article of this kind, production costs would be considerably reduced, prices would be lower and more stable, difficulty of replacement would be obviated and general service efficiency would be vastly improved.

Plug Troubles

In even a modern engineering factory the provision of suitable plugs presents a problem, and one still sees the maintenance electrician struggling to fit a 3-A plug on the end of a flex as thick as a rope or a 15-A fused plug to flex as thin as string. When he goes round the works to test portable appliances, he has to arm himself with a series of short leads with plugs attached.

Regardless of experience since the advent of the gasfilled lamp and small 25- to 50-V lighting sets, a lightly constructed b.c. lamp holder is frequently used with the higher-wattage or lower-voltage lamps. The heat of the lamp or the heavier current causes the plunger to heat and lose its tension, resulting in lamp flicker or failure of the light. This could easily be avoided by the use of stouter holders.

The time and inconvenience of localising a fault would be minimised by inserting a fuse in every lighting point, socket outlet and portable appliance, especially where points are scattered. In the old days it was the practice to fit a fuse immediately above the local switch, whereas to-day six to ten lights may be in one circuit with the fuseboard at some distant inaccessible place. When a fault occurs the electrician has to grope his way in the dark to the fuseboard. Procuring a ladder, he replaces the fuse after putting several other circuits momentarily off in the process of finding the right one. The new fuse may blow immediately, and then comes the slow process of localising the fault. Quite apart from the delay caused in the affected area, very often some vital machine tool, electric furnace or crane elsewhere has been idle for some time awaiting the electrician.

There is too much variety in the design of isolators and switch fuses for satisfactory maintenance. The result of installing cheap switchgear is often reflected in the breakdown of switches when carrying only a proportion of their specified load. As no repair can be safely carried out unless the line is made dead nearer to the supply point, the area affected becomes greatly extended. Repair is often impracticable and replacement a lengthy job, while the output graph goes into a steep dive.

Inadequate Motor Starters

Where this penny-wise pound-foolish policy is adopted in regard to switches used to control three-phase motors, the number of intermittent faults and total breakdowns increases to an alarming degree. It may result in motors single-phasing, stalling under load and running sluggishly, or in overloads tripping or coil circuits failing, all attributable to one leg of the switch not making contact or arcing. Although the condemnation of this type of switchgear is a commonplace amongst maintenance and installation electricians, its low cost has unfortunately proved attractive in higher circles.

Solid conduit is still fixed in or near machines and locked securely to switches, etc., allowing no flexibility to compensate for vibration. Machine manufacturers have realised this and are using armoured cables or flexible conduit and in some cases, copper-sheathed, powder-insulated cable. Not so the installation engineer, who will rarely depart from the use of solid conduit, except when motor slide rails or suchlike force him to do so. Despite the many faults that occur due to the cable shearing off when connected to or near a moving contact, he often continues to use a three- or seven-stranded cable instead of a more flexible one.

The demand for a wide range of speeds on machines doing precision work has once more brought the DC motor and generator to the fore. Large numbers of DC motors are running to-day that have been in constant use six days a week for thirty or forty years. In these machines manufacturers have been generous in both material and HP rating, and the designers sympathetic to the maintenance man, but hasn't it been worth it?

As with all commutator motors constant care and attention are absolutely vital. Accessibility should be a chief basis of design and erection. Yet with most present-day motors from 10 HP downwards, the brushes cannot be bedded properly, even in the workshop, let alone when installed (as they so often are) in inaccessible positions. Bottom brushes are most affected; consequently even to free the brush or adjust the tension involves a series of contortions. In some isolated cases with four-pole motors this has been obviated by fitting only two sets of brushes. These being placed at the top quarter of the rocker allow adequate space for cleaning the commutator. Where two or more brushes are fitted on one spindle it is common practice to renew only one brush, leaving the others partly worn. This is done chiefly for economy and to save bedding the new one in by allowing the worn brushes to carry the load until the new one finds its own bed.

Such a procedure as this results in uneven grooving of the commutator, which goes from bad to worse until it is skimmed. Very-low-voltage generators with high amperage output are more susceptible to this trouble. During the bedding period, the current takes the path of least resistance, and so the shorter brushes constantly carry the heavier current, thus increasing the grooving.

Demonstration Apparatus

Recent Advances for Securing Accurate Results

By C. C. Downie

EFFORTS have been made of recent years to improve the equipment and apparatus used for demonstration purposes in modern training centres so that all kinds of physical and associated optical and electrical experiments may be carried out with the utmost precision and with the least waste of time. This subject has become more acute with the desire to expedite researches which may require to be undertaken at very short notice as a result of the present conditions. Interest appears to be centred largely on portable equipment or, alternatively, on components which can readily be transformed for other purposes.

A new design of contact plug has been produced, known as a "knife plug," in which a resilient metallic strip presses a contact strip in an outward direction, whereby the knife-like edge always ensures a good contact on the wall of the socket. A more elaborate type of threaded contact plug has a thick flattened head with an insulating covering and a radial drilled hole into the front-surface of which a terminal screw with insulated knurled head is screwed. By this means pegs and wires may be clamped in the drilled hole, while between the screw-head and principal piece, cable eyes may be tightly held.

Small automatic switches are invaluable for experimental work. These are simply set up on wooden stands and act in the capacity of a fuse as well as a switch, thus preventing injury to perhaps sensitive equipment, even in the event of heavy and unexpected short-circuits. Despite the fact that automatic switches of the kind are exclusively adjusted for use either with AC or DC, they may be utilised for both. With AC, however, the tripping currents are slightly lower, as the action of the switch is governed by the peak value of the current.

The switches are produced as current limiters, with a deviation of ± 10 per cent. for seven different current intensities between 2 and 25 A, whilst the voltage drop across the switch varies, depending upon the magnitude of the current, between 1·2 and 0·1 V and, accordingly, in the case of low voltages may be ignored. One of these small automatic cut-outs recently introduced for demonstration purposes approximates to $5\frac{1}{2}$ in. in length, by 5 in. in breadth, and 7 in. in height.

On overload or short-circuit, the armature of the magnet (through the windings of which the entire current flows), strikes against a spur on the toggle-lever and trips it. A strong spring separates the contact surfaces in rapid switching action, while the handle of the switch falls back to the "out" position. Should the overload continue, throwing-in of the switch is impossible. The magnitude of the releasing current is adjusted by means of a spring situated beneath the armature. Another desirable innovation is a small, movable connection table to which cable is led up in metal tubing, and upon which series resistances for arc-lamps are screwed to the table-leg.

A test resistance suffices for ordinary experiments in electricity where DC voltages only are available. Portable types have a main resistance of 80 ohms, increasing with the cross-section of the windings, and an auxiliary safety resistance of 22 ohms. When the shunting switch remains open, current values from 0 to 10 A may be regulated, first with the main resistance and then with the auxiliary resistance. As a safety measure, a limit stop is set at 15 ohms. Where both switches are closed, the apparatus serves as a potentiometer for voltages between zero and line voltage, the voltage being regulated first with the auxiliary and then with the main resistance. Portable resistances DC of this kind measure about 12 in. by 12 in. by 20 in. high.

In order to vary AC gradually, a small transformer with one-handle clamping device has recently been introduced. It consists of a core with removable yoke, and a set of readily interchangeable windings. The windings are capable of withstanding a continuous load of 300 W and, for short periods, 600 W, whilst by means of various windings, the secondary voltage may be regulated in numerous steps from 2 to 10,000 V. The width and height of the core each approximate to only 6 in. This miniature accessory can be employed alike for important experiments with glow lamps and other optical researches. When a dry rectifier is connected in series, tests can also be carried out with the usual values of DC.

Portable Resistance Units

Resistances equipped with inductionless windings for DC and AC are specially designed for instruction purposes and, like variable resistances, are operated by specially formed sliding contacts, while regulating transformers are set up on similar lines in which both measuring instruments and switches are incorporated. The idea of this is that the equipment is represented by a completed unit and, being small and portable, can be taken from place to place where experiments, or demonstrations, are demanded on short notice. Even the smallest regulating transformers are equipped with tap-off windings for line voltages, not to mention separate windings, and undue temperatures do not occur as a rule. The range of regulation extends up to 20 A at 220 V, or to 45 A at 75 V.

Many of the smaller transformers suffer from large leakage and, although a perfectly uniform regulation is obtainable, this frequently results in a considerable voltage drop at higher loads and for this reason a fresh design was brought out. The latter is intended for connection to the city mains with windings closely arranged over each other. The leakage is so small that transformed voltages from 2 to 20 V drop approximately by 5 per cent. only with a 10-A load.

Formerly, much trouble was experienced in carrying out research and electrostatic experiments by the use of electrostatic generators, which were very sensitive to moisture and light. Since the maximum AC voltage of 10 kV corresponds to 14 kV DC, these may be replaced by a rectifier. Small capacity rectifiers for high voltages have been constructed consisting of a valve tube and condenser earthed on one side, to the terminals of which AC voltages up to 10 kV may be applied. A switch serves for changing the polarity, an adjustable spark-gap for protecting the installation and a further device for discharging the capacity. A DC voltage with a maximum value of 10 kV measures 12 in. by 8 in. by 14 in. total height.

Rectifiers for Elaborate Experiments

An alternative type of the latest model has a special induction coil, having a spark-gap of 20 mm., which may be directly connected to the line voltage, whilst a built-in oscillating circuit produces a counter-voltage, which prevents an arc or spark from forming at the interrupter. For more elaborate electrical experiments, portable rectifiers of higher capacity are used, which to-day consist essentially of two parts, and thus can easily be moved through doors. These are used for the most important researches in the electrical field of physics.

The equipment is housed in two cars, electrically connected, and fastened together. One car has a switchboard built in the form of a desk, the switching equipment being on the low-voltage side, including an isolating transformer, in the heating circuit of the valves. This car also has the line protective switch, transformer with rotating regulator for a practically stepless variation of the voltage from zero to maximum, together with high-voltage transformer, and AC measuring instruments. The second connected car contains those parts belonging to the high-voltage side, heating transformer, high-voltage switch, pole-changing switch, overload release, cathode choking device (including choking coil and condenser) and the appropriate measuring instruments.

Death after Climbing Pole

AT an inquest at Ilkeston recently on Alfred Ezra Stanway (40), a lorry driver, who was found dead at the foot of a 11-kV pole, the Nottingham coroner said he could only come to the conclusion that deceased "died from electrocution following climbing up the pole, but there was nothing to show what he was doing there."

It was stated that he had been engaged in conveying workmen of the Derbyshire & Nottinghamshire Electric Power Co. to and from work, but he had no authority to climb the pole. Mrs. Stanway, widow of deceased, said her husband had told them at home that he had climbed poles before.

Tariffs for War and Peace

Demand as a Factor in Price

By D. J. Bolton

ELECTRICITY tariffs are having a difficult time of it just now. They are being called upon to satisfy something very different from, often just the opposite to, their peace-time requirements, and whilst the supply machine (on the domestic side at least) is crawling painfully along in reverse, its charges are subject to a barrage of criticism both from within and without the industry.

In lay quarters tariffs can always be counted upon to have a bad press, and the paragraphist of the evening papers is never so happy as when exposing some scandal of high prices or unfair incidence. This is natural enough and need not be taken too seriously. We all enjoy our price grumbles, and have a profound conviction that what we buy is too dear and what we sell too cheap.

With electricity tariffs there is a second and even choicer material for grumbling. Even when the price is not thought too high the form of the tariff is often objected to, and in particular it is attacked as being too complicated. Here perhaps the consumer is on to something more legitimate by way of a grievance, and even the supply engineer who has a perfectly clear conscience on the score of overcharging may sometimes be a little uneasy on the latter ground.

Nor are the two complaints—magnitude and complexity—entirely unconnected, at least in the consumer's mind. He suspects that if it is really necessary to employ such seemingly devious modes of charge there must be something shady about the whole thing. Annoyance with the form of the account raises doubts as to its content, and an amount may then be queried when a larger figure based on a simpler plan would pass unchallenged.

Complicated Simplicity

But a plea for simpler tariffs does not only come from outside the industry. It is fair to say that no tariff discussion takes place and no October crop of chairmen's addresses makes its appearance without at least one appeal for simpler and less roundabout methods of charge. Sometimes it is less an appeal than a command, almost an ultimatum delivered in fiery tones, or it may be only the still small voice of the flat-rate-ist who, like the flat-earth-ist of the past, is vainly protesting against the decision of the majority. Often, however, the prophet of simplicity is a complicator in disguise. Like the simple-lifer whose life often proves so much more complex than the conventional existence, the tariff leveller is only clearing the ground in order to erect a still more complex rate.

Granted, however, that simplicity is a tremendous asset, and one rarely to be fouud in electricity tariffs, the question is how far can we actually go in this direction. In his chairman's address to the Measurements Section of the Institution of Electrical Engineers, Mr. E. H. Miller seems quite prepared to go the whole way. He suggests a single national flat rate for all purposes, though with rebates for large commercial undertakings. One might perhaps follow this suggestion a short way in the case of the domestic load, and see just where it will lead one.

Flat-Rate Limitations

In the recently published abbreviated returns of the Electricity Commissioners the mean selling price for lighting and domestic supplies was given as slightly over 1.5d. per kWh (somewhat less when the commercial load is excluded). Very well, then ; what is wrong with a single flat rate of 1½d. per kWh to all householders for all purposes ? Such a tariff would apparently bring in the revenue required (one is speaking in terms of pre-war prices) and it is certainly simple enough. Such an assumption, however, is a somewhat naive one, and is rather like seeing a photograph of a horse leaping a fence and assuming that the horse has solved the problem of levitation. Momentary equilibrium does not necessarily mean stability, and in order to see if a system is in balance or stable equilibrium the engineer postulates a small change and tries to see what will happen therefrom. When a new electrical service is in contemplation or some change in consumption is mooted will such a price induce the increase ?

One imagines the average householder being told that the mean cost of his supply is 1.5d. per kWh, and that in future he would be charged just this. Would he not say " I am not so much interested in what it costs you as in what it is worth to me. For lighting and wireless, electricity is worth several times three-ha'pence and I shall continue to use it so, but for cooking and water heating it is not worth so much and in future I shall use gas or coal." The result is we should soon be back where we were thirty years ago (as regards character of load, though of course with a greater number of consumers). Our expensive street distribution system would be carrying a lighting load for two or three hours (and the same two or three hours) each day, and almost idle for the rest of the twenty-four. In a very short while the costs would *not* be 1½d. or

anything like it, and the consumer would soon have to be paying several pence per kWh with no cheap rate to follow on. A price of 1½d., in fact, does not correspond with value in any of the main domestic uses—it is just about half its worth in some fields and twice its worth in others.

There are many questions to ask of a new tariff proposal, but two are paramount—"Will it pay?" and "Will it work?" The former is largely a question of magnitude—a simple equating of present costs and revenues—but the latter is a matter of structure and future development. Supply engineers have to preserve a nice balance between what the consumer wants (and is willing to pay for) and what the supply costs. This balance is no static affair but a kinetic balance of actions and reactions, and the mere working out of a few averages will no more tell us what to charge than a few "stills" will tell us what a moving picture is like.

Facts of Supply and Demand

The main facts of the situation, both on the supply or costs side and on the demand or sales side are not open to dispute, and these facts are hardly compatible with a simple flat-rate energy charge. Two simple facts dominate the cost situation, namely that only about one-eighth of the total (pre-war) cost of electricity supply goes in items proportional to kWh, and that capital expenditure on distribution is about one-and-a-half times that on generation and main transmission. The significance of the second fact is that distribution capital is an irreversible non-transferable expenditure through which the supply industry has built up an invaluable localised service, and if consumers change their demands or move or for any reason cut down their consumption the recoverable portion of this expenditure is very small indeed. A simple index to this economic make-up is provided by the fact that the capital expenditure in electricity supply is approximately seven times the annual revenue, against four times in the gas industry.

The main facts on the consumers' side also lie on the surface, and the most important of these facts concerns the elasticity of demand. Some services have an inelastic response, and this applies to electricity used for radio, for refrigeration, for vacuum cleaning, and to some extent for lighting. Fond though some people are of leaving their wireless on, I have yet to hear of anyone using it more because electricity is cheap. Nor does the housewife, however much of a domestic economist, use the cleaner half an hour longer or open the refrigerator door more often because electricity has gone down to a halfpenny a unit. Such uses are limited largely by apparatus and wiring, and very little by the cost of current. Hence, if we are to lower the price of electricity with a view to extending its use, it is a waste of time to lower it for such purposes. On the other hand, electric cooking, water heating, etc. represent a highly elastic demand, and a drop in price (backed by the necessary publicity and apparatus facilities) will materially increase the electricity sales.

If we define elasticity as the percentage increase in sales for a 1 per cent. drop in price it might well be found that the elasticity of lighting and wireless sales was only one-quarter whilst the elasticity of heating and cooking sales was two or four. For sales development it is therefore essential to employ either a multiple tariff which distinguishes between the different uses of electricity, or else a multi-part tariff whose effect is to charge more heavily for the first block of "essential-service" units.

Some would say that we have no business to consider value in our pricing, our job is to allocate costs and to pass these on to the consumer. But surely the consumer himself provides the answer to this objection, his answer being embodied in this very elasticity index we have been discussing. For though the occasional consumer may voice his opinion on the price of a service the great bulk of the public express their views by their actions, *i.e.*, by buying or refraining from buying the service in question. It may therefore be laid down as a general working principle that, whilst lowered costs form the reason for lowering *mean* prices, the argument for lowering any *particular* price should be that of promoting its more extended use. Only so can one be sure that the reduction is performing the greatest service to the public.

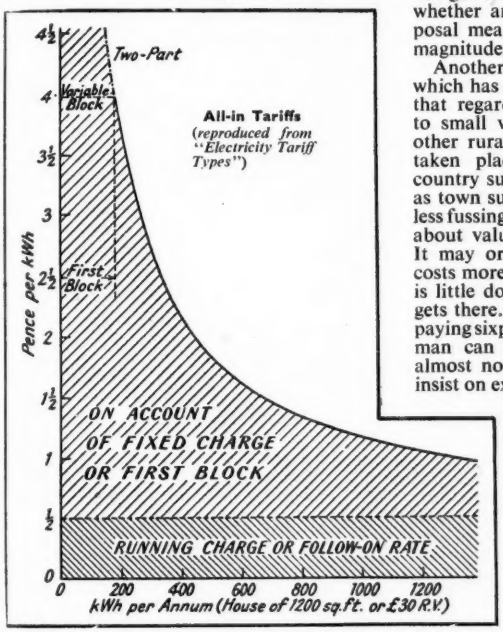
"Regional" Standardisation

Besides the tariff proposals put forward in the I.E.E. Measurements Section address, some suggestions were made by Major R. H. Rawll in the chairman's address to the South Midlands Centre. He also proposed that there should be one tariff (but only in each area) for all lower-voltage supplies whether domestic, commercial or industrial, the actual rates charged and the form of the tariff to vary with the undertaking. It is difficult to see, however, why a rate should be the same for all purposes whatsoever in a given area and yet change both in size and in type as soon as it crosses the border into another undertaking's area. To pay one price whether for lighting or water heating for motive power or battery charging and yet to pay a different price for lighting in Manchester from what one pays in Liverpool or Salford does not seem to accord either with costs or with service value. Any such suggestions for disregarding use are likely to founder on that obstinate hidden rock, the user himself. Though it may not be true that the consumer is always right he certainly has

the ultimate veto, and no amount of talk about mean costs will make him pay more than its value to him. Probably whatever electricity is priced at (within limits) every householder will buy some of it, but before he will buy that extra unit he must feel it to be worth his while, and that depends on the use he is making of it.

Nomenclature and the Scott Report

All this may seem somewhat negative and critical, so let us make some positive suggestions. The first and most important thing in tariffs is to know what we are talking about. In no branch of technology have so many hours been wasted at cross purposes merely through a misunderstanding of the terms. So strongly does the writer feel this that he has recently produced a booklet devoted solely to clearing the tariff ground, defining its terms and types, and summarising certain recommendations thereon.* The very word "tariff" itself covers two entirely different things, the structure and the magnitude, and it would be a salutary injunction if everybody who uttered those blessed phrases "standard tariff," "single tariff for all" etc. were compelled to say before going any further whether they were discussing the framework or the content.



* "Electricity Tariff Types," Chapman & Hall, Ltd.

An excellent sad example of the uncertainties of nomenclature is to be seen in the recently published Scott Report. Probably no sentence therein has caused more searching of hearts and wringing of hands amongst supply engineers than that which calls for a standardisation of charges "preferably on a flat rate per unit." As it stands, such a recommendation is rightly characterised by Mr. Sumner as a "retrograde suggestion," but does it in fact mean what we mean by a flat rate? Is it not at least as likely, in view of the remainder of the sentence and of the general tenor of the Report that what is really intended is "preferably on a *uniform* rate per unit, with two-part tariff facilities." Whether this is so or not, we shall certainly not get far in our discussions until we know whether any particular standardisation proposal means a standard type or a standard magnitude.

Another Scott Report recommendation which has alarmed the supply economists is that regarding the provision of free service to small villages and supply on request to other rural premises. Much discussion has taken place on the question of whether country supplies can be furnished as cheaply as town supplies, although here again a little less fussing over costs and a little more thought about values would save many a headache. It may or may not be true that electricity costs more to take into the country, but there is little doubt that it is worth more when it gets there. Does the townsman complain of paying sixpence for a cabbage that the countryman can buy for threepence or grow for almost nothing? Nor will the countryman insist on exact equality with the town price for his electricity provided (a) that he can get it, (b) that it is worth its price, and (c) that the undertaking is not excessive in its profits or extravagant in its operations.

Consider two services only—which every rural householder would welcome without exception—those of lighting and mains wireless. One knows of villages where the average household spends several shillings a week on battery charging and oil alone. Besides this there is the occasional high-tension purchase, the not infrequent fade-out, the lamp and wick cleaning, and all the fetching and carrying involved. Now the average cost of domestic supplies (1937-8) came to 12s. per quarter per consumer plus ½d. per kWh, and if the rural distribution fixed charges were actually double the present average (generation costs being unaltered) the price would still be less than 1s. 6d. a week plus the ½d. running charge. Is it seriously suggested that a weekly charge of 6d. to 3s. (depending on the size of house) would be

thought too much to give for the ability to buy electricity, with all that this means, for ½d. per kWh? The vital fact of rural electrification in a word is not its cost but its value, and this is a reason for electrifying as quickly and thoroughly as possible, charging whatever may be found to be necessary.

Wartime Domestic Tariff

Whilst in most areas the peacetime tariffs have served remarkably well under war conditions it is inevitable that friction will occasionally arise. This is particularly so with the two-part tariff since the whole existence and purpose of this rate lies in its promotional character. A tariff which is expressly designed to expand and diversify consumption can hardly be blamed if it is not a perfect vehicle for carrying out a reverse policy. But those who ask that this tariff shall encourage their target aims and reward their patriotism by a yastly reduced electricity bill are somewhat unreasonable in their demands. Do they, one wonders, after cutting their baths down to the five-inch level expect a reduction in the water rate? In view of the economic supply facts outlined above, it is clear that when the householder reduces his consumption most of the costs are still incurred, and anything like a proportional reduction in the account is out of the question.

The crux of the matter is, of course, the fixed charge, and doubtless there are hard cases where owing to exceptional war conditions the use made of the supply in particular periods does not seem to justify the charge made. Under these circumstances some undertakings give their consumers not merely the option of changing over to the flat rate but even of making the best of both worlds by being charged at every quarter by the lower method whichever it happens to be. Such chopping and changing can hardly be regarded as ideal either for the consumer or for the accounts of the undertaking, and there is then much to be said for putting the tariff permanently on a basis where such a contingency is automatically provided for. This occurs in the variable block tariff.

In effect this operates very much like a two-part all-in tariff of the usual kind, but in form it is a block rate consisting, usually, of two blocks only. The first block is priced at the normal lighting flat rate (or slightly higher) and the second block comprising all the remaining consumption in that quarter is priced at the low follow-on rate. The size of the first block varies with the consumer and depends on exactly the same features as does the fixed charge in its usual form.

The following table shows a two-part and a variable block tariff side by side, with values adjusted to give similar overall results. The figure shows the results graphically.

COMPARISON OF ALL-IN DOMESTIC TARIFFS.

Basis of fixed charges	Two-part. Fixed charge (per annum)	Variable-block. Number of kWh at 4d. (per annum)
Up to 800 sq. ft. or £20 r.v.	£2 0 0	136 kWh
801 to 1,000 sq. ft. or £21 to £25 r.v.	£2 7 6	162 ,,
1,001 to 1,200 sq. ft. or £26 to £30 r.v.	£2 15 0	188 ,,
Each additional 200 sq. ft. or £5 r.v.	add 7 6	add26 ,,
Running charge of ¼d. per kWh	all kWh	all subsequent kWh

The special advantage of the variable-block rate for the present times is that it is a single tariff capable of covering the whole domestic field without alternatives. Consumers do not need to declare which tariff they want to be on : if their load is small they will be paying the lighting price, and as soon as their consumption overflows the first block size they automatically come on to the lower rate. No fixed charge is levied as such.

The rate has this danger for the undertaking that if the consumption in any quarter is low for the size of house the load may become unremunerative. The same applies however to the flat rate which is the statutory alternative to the normal two-part tariff, and in both cases the difficulty is partly met by a minimum quarterly charge. (The effect of this is not shown in the figure.) The only point in the range at which the undertaking is liable to lose revenue is when the consumption hovers about the first block size, since a consumption somewhat below will bring in slightly less than with the two-part whilst a consumption above will bring in less than with the flat rate. If necessary, this can be covered by making the first block price or the first block size slightly higher than the figure required to equate with the two-part tariff.

The "Step-up" Tariff

One other wartime device ma be men-y tioned—that of the "step-up" tariff. This was fully described in these columns by Mr. R. B. Rowson * and has just been adopted by the Mountain Ash undertaking. † As an aid to "target" practice it would appear to be excellent, but for normal circumstances it hardly corresponds either to value or to cost. If there are two similar households, one consuming 200 and the other 1,000 kWh a year, the value of an additional kWh is likely to be less to the second user than to the first, and if he is charged more for it he will probably go without. Which is precisely what is wanted at the moment, but not (let us hope) in the future.

* *Electrical Review*, October 16th, 1942, p. 486.
† *Electrical Review*, November 6th, 1942, p. 576.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

The Central Register

A STATEMENT made in a letter signed "A.H.G." in your issue of December 25th, cannot be allowed to pass unchallenged, because it tends to perpetuate an unfortunate fallacy which it is apparently impossible to destroy. Your correspondent states : "From this total (170,357) 19,000 appointments have been made, leaving a considerable balance still on the Register *and presumably available for appointment*."

This is a complete fallacy. Practically all the engineers on the Central Register are already employed in engineering jobs. Out of some 30,000 electrical engineers on the Register at the end of 1941 only about 150, that is 0·5 per cent., were unemployed, and there was usually a good reason even for this. The appointments do not in any sense represent the number of unemployed men placed in employment, but the number of vacancies notified to the Central Register and successfully filled by a difficult and delicate process of *transfer* from existing employment to more urgent employment. In other words, 19,000 engineers have been moved from their previous jobs to jobs of greater national importance in which their qualifications are more fully utilised.

The Central Register will have achieved perfection not when it makes a greater number of appointments but, in fact, when the appointments which it makes *fall to zero*, since every appointment represents improvement and perfection cannot be improved upon.

London, W.C. C.W.O.

I WAS recently offered, through the Central Register, a post as assistant electrical engineer in a Government Department. I had to pay my own hotel expenses for an interview in London, and, when appointed, the expenses of joining the station.

Eventually I was directed to be resident engineer in a disused limestone mine which was to be fitted with electric lighting. The mine was waterlogged, and only continuous pumping kept a portion of it dry. The roof crust was about eighty feet thick and was gradually collapsing. There had been many heavy falls of rock, the supporting pillars were cracked and in every way it was unsafe for electricians to work in. The civil engineer in charge had reported the state of the mine and refused to be responsible.

As the resident engineer on such a job would be liable to a charge of contributory negligence in the event of an accident if he directed mechanics to work under such conditions, I resigned the job, as had the man who was previously appointed.

This is all the Central Register has done for me up-to-date after three years of war. Most of the staff of the department where I was employed were about thirty years old or less, and I got the impression that it is not the policy of Government to encourage the use of older men. That may be the reason why comparatively little use has been made of the Central Register.

Hull OVER FIFTY.

H.R.C. Fuses

I AM in cordial agreement with most of the conclusions reached by Mr. S. H. Fowles in his article in your issue of January 1st, but consider certain comments desirable. In the first place, the use of rating differences in preparing fig. 1 is open to objection ; for example, discrimination between fuses rated at 50 and 100 A in any particular circuit would be much more likely than between fuses rated at 400 and 450 A. I therefore suggest that it would be preferable to plot the ratio of the fuse ratings rather than their difference.

Secondly, the tests quoted were made on DC circuits. The results to be expected with AC, while generally similar, would show certain significant differences. Thus, if the prospective current is many times greater (say 20 to 60, increasing with fuse rating) than the fuse full-load rating, the cut-off current, as can easily be demonstrated mathematically, is inversely proportional to the cube-root of the circuit inductance, whether the supply is DC or AC. In the DC case this condition is represented by the level parts of the curves in fig. 2, the cut-off current remaining at a maximum since the inductance is fixed.

With AC at any given short-circuit power factor, the inductance is inversely proportional to the prospective current, the result being that the cut-off current increases continuously as the cube-root of the prospective current. At 33 kA RMS symmetrical current (corresponding to 25 MVA at 440 V, three-phase) the cut-off current for a multi-silver-element fuse is usually of the order of 100 times the full-load current.

Successful discrimination between fuses of closely adjacent ratings depends on a low value of the ratio of arcing time to pre-arcing time, while arcing time itself increases with increase of the system recovery voltage at the time when arcing is occurring. Comparing DC and AC circuits of the same nominal voltage, arcing in the fuse in the

AC circuit is thus more prolonged than with DC if it commences shortly before a peak of the system voltage. It follows that successful discrimination in an AC circuit may necessitate a somewhat larger difference in fuse ratings than if the circuit were DC, the prospective current being the same in the two cases.

Finally, I do not understand the construction of fig. 5 ; it appears to me that the time-constant can only increase in direct proportion to the conductor cross-section if the inductance of cables of different cross-sections is the same.

Witton. J. W. GIBSON.

Factory Lighting and Ventilation

PRODUCTION is vitally important and, to achieve this end, so are good lighting and ventilation. Quite frequently one reads in the daily Press the appointment by the Ministry of Production of industrial advisers, progress advisers and advisers on production capacity, but I do not remember the appointment of an authority on industrial fatigue. Surely this is of great importance for industrial fatigue must have an adverse effect on production and there is no doubt that bad lighting and ventilation in factories are the main causes of industrial fatigue.

In the E.L.M.A. Handbook No. 2 I read: " Permanent damage to the eyesight and to health can result from prolonged exposure to seriously ill-lit conditions, while the effect of bad lighting upon both quality and quantity of work is extremely marked," a further passage in this handbook states that " carefully controlled tests under factory conditions have shown that higher levels of illumination increase production."

I am a production chaser for a Government Department, and I visit a large number of factories all over the country, factories engaged on most vital work. I find that the lighting and ventilation are appalling. The Chief Inspector of Factories has criticised the conditions but the shortage of labour and materials has precluded the removal of defects. These conditions should not be allowed to continue and Factory Inspectors should be instructed to see that they are improved. The Minister of Production should also intervene if he wants production stepped up. Factory workers should have good lighting and ventilation ; there are still available engineers who could advise on these subjects and the matter should be dealt with at once.

CHARTERED ELECTRICAL ENGINEER.

Harrow.

Forthcoming Events

Institution of Electrical Engineers.—Monday, January 25th, 5.30 p.m. Informal discussion on " Electric Power in Plating Plants " to be opened by Dr. J. Kronsbein. (Joint meeting with Electrodepositors' Technical Society.)

Wireless Section.—Tuesday, January 19th, 5.30 p.m. Informal discussion on " Quartz Crystal Applications " to be opened by Capt. C. F. Booth.

Measurements Section.—Friday, January 22nd, 5.30 p.m. Paper : " Boiler House Measurements and Control for Efficient Fuel Utilisation," by Messrs. G. H. Barker and A. L. Hancock.

West Wales (Swansea) Sub-Centre.—Saturday, January 16th, 3 p.m. Mackworth Hotel, Swansea. Chairman's address by Mr. A. C. Thirtle.

North Midland Centre.—Saturday, January 16th, 2.30 p.m. Leeds County and Conservative Club. Informal discussion on " Recent Developments in Industrial Installation Practice with Special Reference to Wartime Relaxations," to be opened by Messrs. J. G. Craven and E. A. Fowler.

London Students' Section.—Monday, January 18th, 7 p.m. Informal meeting (Problems Night).

North-Eastern Centre. — Monday, January 18th, 6.15 p.m. Neville Hall, Westgate Road, Newcastle-upon-Tyne. " Old Timers " Night. Informal discussion on " Continuity of Supply." —Monday, January 25th. Paper : " Coal for Steam Raising," by Mr. J. N. Waite.

Irish Centre.—Thursday, January 21st. Paper: " Some Problems in Transmission Line Design," by Mr. A. Burke.

North-Western Centre.—Saturday, January 23rd, 2.30 p.m. Engineers' Club, Manchester. Paper : " Standardisation as applied to Industrial Electrical Instruments," by Lieut.-Col. K. Edgcumbe, T.D. *Students' Section.*—Saturday, January 16th, 2.30 p.m. Engineers' Club, Manchester. Paper : " High Vacua and Electrical Equipment," by Mr. F. Armsworth.

Association of Mining Electrical and Mechanical Engineers.—*South Wales Branch.*—Saturday, January 23rd. Cardiff. Paper : " Electrical Breakdowns, Causes and Their Prevention," by Mr. W. Todd.

London Branch. — Thursday, January 21st, 4.30 p.m. Junior Institution of Engineers. Paper by Mr. J. F. Shipley.

Ignited Varnish Vapour

AT the Manchester Assizes last week Mr. Justice Stable awarded £430 damages and costs to Miss Rose Oliver (21), who suffered severe burns on the neck, arms and legs while working at the paint and varnish works of the Metropolitan-Vickers Electrical Co., Ltd. Liability was admitted.

Mr. C. M. W. Elliott said Miss Oliver was painting the exhaust hood of a gas plant when inflammable vapour from a varnish mixture ignited. Skin-grafting had been necessary.

Mr. Justice Stable, referring to Mr. N. J. Laski's point that the company took every precaution for the safety of its employees, said there was always the human element against which it was impossible to guard.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE recommendation of the Norwich Electricity Committee that **Mr. G. V. Harrap,** technical assistant, West Ham Electricity Department, should be appointed deputy electrical engineer at Norwich (*Electrical Review*, December 25th), has been confirmed by the City Council.

Mr. G. V. Harrap

Mr. Harrap, who is a frequent contributor to the *Electrical Review*, was educated at Salford Secondary School and the Manchester College of Technology and served his apprenticeship with the Metropolitan-Vickers Electrical Co., Ltd., being awarded a scholarship by that company to Manchester University. He has held previous appointments with Dundee Corporation Electricity Department, the North-Eastern Electric Supply Co., Ltd. (with whom he was engaged on the construction of the Dunston "B" station) and Hull Corporation Electricity Department. He was section secretary at Dundee and Hull and assistant secretary at Newcastle of the E.P.E.A., has served on I.E.E. Students' Committees, is a member of the Informal Meetings Committee of the I.E.E. and of the Institute of Industrial Administration and has lectured at Woolwich Polytechnic on management, administration and workshop organisation.

Mr. Harrap has written a great deal on air-raid damage and its repair for the British and American technical Press.

Mr. J. L. Rooney, M.Eng. (Liverpool), A.M.I.Mech.E., A.M.I.E.E., assistant station superintendent at the Clarence Dock power station, Liverpool, has been appointed chief assistant engineer and power station superintendent to the Watford Corporation Electricity Department, at a salary of £893 per annum.

Mr. J. L. Rooney

Mr. Rooney served his apprenticeship with Capstick, Carefull & Co., Ltd., of Liverpool, from 1918 to 1923, which was followed by three years as a student at Liverpool University School of Electrical Engineering, where he took the degree of B.Eng.(Hons.). In 1926 he went to the Lister Drive power station, Liverpool, as assistant boiler house engineer, and three years later became assistant shift engineer. In 1931 he was transferred to the Clarence Dock power station as shift charge engineer, later becoming senior charge engineer, and in June last year he was appointed assistant station superintendent.

Mr. R. J. Harvey, M.Inst.C.E., M.I.Mech.E., M.I.E.E., consulting engineer of 34, Victoria Street, London, S.W.1, informs us that he has resigned the joint honorary secretaryship of the Association of Consulting Engineers. Mr. Harvey has assisted the Association in this capacity for the last six years.

Mr. A. J. Leyland has been appointed a director of the Automatic Telephone & Electric Co., Ltd.

Mr. C. Bradley, A.M.I.E.E., who has been appointed deputy general manager and engineer to the Finchley Corporation Electricity Department, has been at Finchley as consumers' engineer since the domestic development programme commenced in 1936. He was responsible for the sales scheme and had the satisfaction of seeing 4,500 cookers installed under the terms of the Department's two-part domestic tariff. In April, 1941, he was appointed deputy communal feeding officer and was associated with the inception and operation of British Restaurants and emergency feeding schemes within the borough. As we mentioned in our last week's issue, before going to Finchley Mr. Bradley was with the Dumfries County Council.

Mr. C. Bradley

Mr. A. Kemp, assistant telecommunications controller at Manchester, has been appointed telephone manager for Preston, in succession to **Mr. J. C. Macdonald,** who has retired. Mr. Macdonald, who entered the Post Office service in 1912, previously held positions at Leeds, Gloucester and Glasgow.

Mr. W. H. Cope has retired from his position in charge of G.P.O. telephones in the Chester and North Wales area. He is succeeded by **Mr. W. G. Luxton** of Bristol.

Mr. D. J. Bolton, the author of the article on "Tariffs for War and Peace" is well known as an authority on this subject which he has dealt with from time to time in this journal and elsewhere. He has recently published a book dealing with "Electricity Tariff Types." He was awarded a Meter and Instrument Section premium by the I.E.E. last session. Mr. Bolton is on the staff of the Regent Street Polytechnic and among his other activities is membership of the London and Home Counties J.E.A. of whose Local Distribution Committee he is vice-chairman.

Mr. D. J. Bolton

At the annual meeting of the Australian Electrical Contractors' Association held in September, **Mr. C. Roy Nilsson** was re-elected president for a fifth term.

Sir Charles Wright has been appointed acting Controller of Iron and Steel in place of Sir John Duncanson who has undergone an operation. Sir Charles resigned the position last September on account of ill-health.

After 46 years with the telephone service, **Mr. R. P. Lowe,** traffic and sales manager of Post Office telephones, Newcastle-on-Tyne is to retire shortly. Mr. Lowe who is a native of Essex, entered the service of the old National Telephone Co., in 1897, and was afterwards attached to one of the London offices. Some years later he was appointed in charge of the sales department for the East London area, afterwards holding similar posts in North London and Norwich. He was appointed traffic and sales manager at Newcastle-on-Tyne seven years ago.

Obituary

Captain B. S. Cohen.—We regret to record the death, which has occurred at the age of sixty-nine, of Captain Bertram Sydney Cohen, who retired in 1939 from the position of Director of Research at the Post Office Research Station, Dollis Hill. Captain Cohen was educated at the City of London School and Finsbury Technical College in the days of Professors Perry and Silvanus P. Thompson, and joined the National Telephone Co., later becoming associated with the G.P.O. Telecommunication Research. During the last war he served in the R.A.F. and carried out research work on aircraft communication. He took up his position as Director of the Dollis Hill Research Station in 1929.

The late Capt. B. S. Cohen

Captain Cohen was awarded the Fahie Premium of the I.E.E. in 1907 and again in 1926 and 1928 and was chairman of a technical commission of the Comité Consultatif International des Communications Téléphoniques á Grande Distance. He was chairman of the Meter and Instrument Section of the Institution of Electrical Engineers for 1938-39, and during that session delivered the Faraday Lecture on "The Long-Distance Telephone Call—A Triumph of Engineering and Co-operation."

Dr. Nikola Tesla.—The death occurred in New York on January 7th, at the age of eighty-three, of Dr. Nikola Tesla, who for many years occupied a prominent place among electrical inventors. He was born in Austria and educated at Carlstad (Croatia) and Gratz, Austria. After joining the telegraph engineering department in Budapest he turned his attention to the design of dynamo-electric machinery. In 1882 he took up a position in Paris and two years later went to the United States, eventually becoming an American citizen.

Among his inventions were an arc-lighting system, a potential method of regulating dynamos and motors, and several designs of AC motors. He did a great deal of work in connection with high-voltage and high-frequency currents, and was an advocate of high-voltage AC transmission against the use of DC favoured by Edison (with whom he worked for a period). It is said that his advocacy influenced the decision to adopt AC transmission from the Niagara Falls plants.

Mr. G. L. Kirkpatrick.—We learn with regret of the death on January 9th, in Edinburgh, of Mr. George Louis Kirkpatrick, managing director of Bruce Peebles & Co., Ltd. He had been with the company for many years and was appointed managing director in 1934. He was a member of the I.E.E. The funeral service took place at the Edinburgh Crematorium Chapel on Wednesday.

The late Mr. G. L. Kirkpatrick

Mr. C. J. Remington, who died in Liverpool on December 31st, aged ninety, was, in the early days of the National Telephone Co., responsible for the construction of the Manchester telephone exchanges, later becoming district manager at Blackburn, and before his retirement he was associated with the Post Office telephones in Liverpool.

Mr. C. E. Crossley.—The death occurred last week of Mr. C. E. Crossley, deputy general manager of the Chesterfield Corporation Transport Department since 1924. He had previously held various appointments in the Electricity and Transport Departments.

Mr. M. S. Blair.—We regret to announce the death, in Adelaide, Australia, of Mr. M. S. Blair, at the age of seventy-nine. After being educated at Jedburgh Academy and Edinburgh University, Mr. Blair served his apprenticeship with Ransomes & Rapier, then joining the staff of Crompton's, Chelmsford, at a time when the foundations of the company were being laid. He was engaged upon the design of electrical plant, thereafter occupying important positions upon design and control of manufacture with Edison & Swan, Marryat & Place, Vickers, Veritys, and British Westinghouse. He then joined the South Australian Government Railway Department and later transferred to the Engineering and Hydraulic Department, where he remained until his retirement about fifteen years ago.

Mr. C. B. Jones.—The death is reported in *Erda* (Sydney) of Mr. C. B. (Charlie) Jones, manager of the branches and Government departments of the British General Electric Co., Pty., Ltd. He went to Australia more than fifteen years ago after sixteen years' service with the G.E.C. in England.

Will.—The late Mr. W. A. Benton, head of the research department of W. & T. Avery, Ltd. left £1,402 (net personalty £1,271).

COMMERCE and INDUSTRY

Waste Paper Recovery. Engineering Wages Proposals.

Paper Salvage Campaign Extended

WHEN the electrical industry's intensive drive for the collection and disposal of waste paper was begun last year a target figure of 5,000 tons for the period ending December 31st was aimed at. Although very good results were obtained they fell short of that figure and so it has been decided by the Electrical Industry Waste Paper Recovery Committee (2, Savoy Hill, W.C.2), that the campaign shall continue for a further three months—to March 31st next.

As the tempo of the war increases, the demand for shipping grows and one of the classes of imports that have to be cut down is paper. This means a reduction in the amount of paper used for "non-combatant" purposes and consequently less to be recovered. It is therefore vital that no paper shall be wasted : that every scrap of used paper shall be collected and sent to authorised dealers for subsequent use in the production of munitions of war.

The Committee has circulated a further appeal to the electrical industry and with it is a reply-paid card upon which the estimated total of paper to be disposed of can be entered. At the same time the amount ready for disposal can be stated and if arrangements have not already been made for its collection the Committee will undertake to see to it. The card also enables the recipient to intimate his willingness to hand over the proceeds to the Electrical Industries Benevolent Association. The current prices for waste paper are given on the card.

It is to be hoped that the appeal will stimulate the movement for the recovery of paper, a movement which is wholly beneficial—to the individual firm, which gets rid of unwanted material that collects dust and occupies valuable space ; to the E.I.B.A., if the proceeds are directed to that body ; and to the nation, which cannot do without ever-increasing supplies of paper for all kinds of purposes connected with the prosecution of the war.

Government Contracts

The Board of Trade has had many inquiries from manufacturers of goods controlled by various Orders asking whether they are free to execute orders received from Government Departments. The Control of Manufacture and Supply Orders (Amendment) (No. 2) Order, 1943 (S.R. & O. 1943 No. 15, price 1d.) formally authorises manufacturers to execute such contracts for goods controlled under the various Control and Prohibition Orders without a licence from the Board of Trade. Certain conditions must be observed if the manufacturer is not the contractor with the Government Department.

The Government contract must specifically refer to the controlled goods in question, or to goods incorporating them, before they may legally be supplied without restriction or licence from the Board of Trade. If the manufacturer himself is not the contractor he may still supply without restriction or licence provided he receives a written declaration, made or endorsed by his customer, that the goods are required in fulfilment of such a contract from a Government Department and that the contract is still in force. The quoting of contract numbers is not sufficient evidence. Any person who acquires any controlled goods in this way from a manufacturer may not, unless specifically licensed to do so by the Board of Trade, use them in any other way than in fulfilment of the contract quoted or in accordance with any instruction he may be given by the contracting Government Department. This arrangement only relates to contracts placed by the various Departments of the United Kingdom Government and does not extend to semi-official bodies, nor to Allied, Dominion or Colonial Governments.

The Limitation of Supplies Orders already authorise the execution of Government contracts quota free. It is strongly recommended by the Board of Trade that registered persons should adopt the above procedure, when supplying goods to contractors free of quota restriction, in order to safeguard their own position.

Electrical Workers' Wages

Results of a survey made last July by the Ministry of Labour and National Service into the average weekly earnings of workpeople in the principal industries are given in the *Ministry of Labour Gazette*. For the week ended July 18th the average wage in the electrical engineering industry amounted to £4 3s., 63·3 per cent. more than in the last week in October, 1938. Workers in the electric cables. apparatus, lamps, etc., industries received £3 15s. 5d. (50·6 per cent. increase), electrical contracting workers £4 8s. 8d. (56·2 per cent. increase) and electricity supply employees £4 10s. 5d. (31·5 per cent. increase).

Engineers' Wage Claim

Last week the Engineering & Allied Employers' National Federation replied to the claim of the engineering trade unions for increases in their members' wages. On behalf of the Federation, Sir Alexander Ramsay put forward a counter-proposal which it was later decided to refer to a joint sub-committee of the two parties for detailed consideration.

The Unions' claim, made in November last, was for an increase of 11s. in the weekly basic rate ; an increase equivalent to 33⅓ per cent. of base rates for all plain-time workers ; and the restoration of the overtime, night-shift and Sunday work conditions as they existed before June, 1931. It was estimated at the time that the granting of these terms would raise the industry's wages bill by between £65,000,000 and £100,000,000 per annum.

New Capital Issues

Statistics have been compiled by the Midland Bank showing the total capital issued annually during the years 1919 to 1942. They exclude all Government borrowing, capitalisation of reserves, conversions, loans of municipal and county authorities which have not been specifically limited, and other special cases. It

is shown that in the first year after the last war (1919) the total was £237·5 millions and it rose to the peak of £384·2 millions in the following year. From 1921 to 1926 the annual amount was fairly steady at between £200 and £250 millions, but there was a substantial rise in 1927 to £314·7 millions followed by a further jump to £362·5 millions in the succeeding year. It fell to about the previous level in 1929 and 1930, but in 1931 (a "crisis" year) the total was only £88·7 millions. Thereafter there was a steady rise to £217·2 millions in 1936 but then a falling tendency set in until it was only £118 millions in 1938. The war commenced to show its effects in 1939 when the total of new issues was only £66·3 millions. Since then, with the restrictions on the issue of new capital, the totals have been as follows :—1940, £4·1 millions ; 1941, £2·3 millions ; and 1942, £3·9 millions.

Research in Industry

The committee which the F.B.I. has set up to consider industrial research has reached certain preliminary decisions with regard to its programme of work. The primary task will be to stimulate the utmost possible interest in industrial research, and a survey is to be made of present activities and an indication obtained of the results already achieved.

The restoration of export trade will be an immediate post-war necessity, and this and our domestic needs will be dependent upon industry's productive and competitive power. This in turn must be largely dependent upon technical advance and research. The committee hopes that its work will not only point the way, but provide a stimulus to all concerned.

The committee, of which Sir William Larke (formerly director of the British Iron and Steel Federation) is chairman, includes among its members Sir Felix Pole (Associated Electrical Industries), Dr. C. C. Paterson (G.E.C.) and Mr. A. L. Hetherington (Department of Scientific and Industrial Research).

Release of Space in Premises

Occupiers of wholesale and retail premises which have a floor space of 10,000 sq. ft. or more are reminded that they must make a return without delay to the Registrar of Factory and Storage Premises, Board of Trade, Neville House, Page Street, S.W.1, from whom the necessary forms can be obtained. Factory premises, hotels, restaurants and premises used solely for the sale of food and drink are not affected by this Order. Copies of the Order, the Storage Facilities (Information) Order 1942 (S.R. & O. 1942 No. 2264) may be obtained from H.M. Stationery Office, price 1d., or through any bookseller. The onus of making returns is on occupiers and not on owners of the premises and the completed forms must be returned within ten days.

Zinc for Die-Casting

The British Standards Institution has recently published at 2s. 3d. (post free) a new British Standard for sampling and analysis of high-purity zinc and zinc alloy for die-casting (B.S. 1005/1942). This specification was authorised by the Non-Ferrous Metallurgy Committee in 1941 in response to a request received from the Zinc Development Association. The standard sets out the methods of sampling and analysis to be adopted for the examination covered by B.S. 1003 and 1004. These umpire methods need not be resorted to for routine control in the production of the zinc or the alloys. The procedure set out is that to be adopted in the case of dispute requiring submission to an independent authority.

Electro-Polishing Steel

In addition to a selection of abstracts of American origin concerning the influence of nickel on various alloys, the December issue of the "Nickel Bulletin," obtainable from the Mond Nickel Co., Ltd., contains data on the electrolytic polishing of plain carbon steels by anodic treatment, which has hitherto presented special problems because this class of steel tends to corrode at a rapid rate in acid solutions as well as usually not being so "clean" as most of the metal sand alloys that are electro-polished. The present paper describes experiments from which five baths have been developed for steels containing small percentages of carbon. Four of them are fully useful commercially while the fifth requires special care in operation.

New Zealand's Electrical Imports

During the three months ended June 30th last electrical apparatus to the value of £(N.Z.)479,084 was imported into New Zealand. The principal items were insulated cable and wire, £113,492 (United Kingdom £80,446, United States £10,854) ; electric motors and parts, £84,197 (United Kingdom £61,138, Canada £17,566) ; and electric lamp bulbs, £25,114 (United Kingdom £23,149). Imported radio apparatus was valued at £59,703 (United Kingdom £24,950, United States £24,424.)

Power Station Shooting Inquest

At the inquest on the two engineers who were found shot dead at the works of the Derbyshire & Nottinghamshire Electric Power Co. at Spondon, Derby, last week the jury returned verdicts that Cecil Henry Dawson, aged forty-one, charge engineer, wilfully murdered Ernest Hezekiah Lynam, aged forty-six, station superintendent, by shooting him and then committed suicide.

In police evidence it was stated that the bodies of both men were found on a spiral staircase and between Dawson's legs there lay a revolver from which two rounds had been fired. In his pockets were two other revolvers, fully loaded, and two boxes of ammunition, while in his motor-car in the car park at the works there were several hundred rounds of ammunition. He had applied for a permit to keep firearms, but this had been refused. Lynam had been fire-watching and appeared to have been walking down the steps filling his pipe when he was shot from behind.

Mr. P. Ormiston stated that Dawson, who had been employed by the company for twenty years, was reported by Lynam about five weeks ago for having absented himself following a complaint regarding the condition of certain equipment under his supervision. The company informed him that the matter was so serious that he would be required to resign, but on the intervention of Lynam he was reinstated.

although in a different job, and thus missed a chance of promotion. He explained that his dereliction of duty was due to domestic trouble. Lynam and Dawson had been very great friends.

Dr. W. B. Roache stated that three weeks ago Dawson had complained of sleeplessness and on the evening before the tragedy he said that he was feeling no better. Witness had advised him to take a rest from work.

Fatality

While Mr. William M'Kay, an undertaker of Letterkenny, Co. Donegal, was overhauling a hearse last week preparatory to its going to a funeral, he received a fatal electric shock. Evidence at the inquest showed that he was using an electric lamp with a long flex, and was standing on a wet concrete floor. The local manager of the Electricity Supply Board said that the portable lamp was dangerous because it had a bad flex connection. A verdict of "Accidental death" was returned.

New "Mazda" Display

A new "Mazda" lamp display piece produced for 1943, is most attractively coloured on cloth, and measures 36 in. by 23 in. Seven cartoons, each a practical suggestion for saving electricity, form the motif and the illustrations are both bold and arresting. Only a limited supply of the display piece is available.

Mica Production in Canada

A considerable increase in shipments of mica from Canadian mines in 1941 is reported in *Electrical News and Engineering* (Toronto). For the year the total quantity was 5,487,891 pounds, compared with 1,950,219 pounds in 1940.

Rational Distribution

In the article bearing this title, by Mr. F. J. Elliott, in our issue of January 1st, reference was made to the additional charges placed upon municipal electricity undertakings in the form of rate relief. It was stated that "undertakings had to meet a charge on this account varying between 2s. and 12s. per annum." This should have continued "per consumer." The actual amounts contributed by individual undertakings ranged from £500 to £24,500.

Flameproof Plant

The customary quarterly list of machines and equipment, both mining and industrial, for which certificates of flameproof enclosure were issued by the Ministry of Fuel and Power (Coal Division) during the three months ended December 31st, 1942, has been issued. At the request of the B.E.A.M.A. a few copies are on sale at 1s. 2½d. each at the Library, Ministry of Fuel and Power, King's Buildings, Dean Stanley Street, London, S.W.1.

The "Electrical Age" in New Form

Though reduced in size, the January issue of the *Electrical Age*, published by the Electrical Association for Women, has lost none of its value. Actually, it appears to contain more matter than before and its appearance has in no way suffered. Certain changes have, however, been made in the contents, which in future will be devoted to the three main items in the economy campaign—food, fuel, clothing and household equipment. News of women of the United Nations will also be included from time to time.

Engineering Students at Liverpool

The Liverpool University authorities report that the number of applicants for the mechanical and electrical engineering courses has increased year by year and there has been virtually a full complement of students throughout the war period.

Change of Name

The British Electrical Federation, Ltd., has changed its name to "The B.E.T. Federation, Ltd." The Federation is the central organisation which provides services to the road passenger transport, electricity supply and other companies associated with the British Electric Traction Co., Ltd. It was formed in 1907 when the B.E.T. Company's chief interests were in tramway and electricity supply undertakings. The B.E.T.'s main business to-day lies in the provincial omnibus industry (although it still has a substantial interest in electricity supply), hence the alteration of the name of the Federation.

Calendars

Brittain's (formerly Langdon-Davies) Electric Motor Co. has sent us a copy of its 1943 calendar, which shows a charming picture of a small boy triumphantly holding a rabbit, entitled "See What I've Got!" The calendar has monthly sheets.

TRADE MARK APPLICATIONS

RECENT applications for British trade marks include the following, objections against which may be entered within a month from January 6th :—

INSU-GLASS. No. 620,069. Class 8. Glass-insulated electric wires and cables.—The Saxonia Electrical Wire Co., Ltd, Roan Works, Road Street, Greenwich, London, S.E.10.

STEADFAST (design). No. 619, 284/7543S. Class 9. (Application made to the Cutlers' Company, Sheffield.) Electrodes for electric welding, etc.—J. Stead & Co., Ltd., Manor Works, Cricket Inn Road, Sheffield.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following :—

LEE ENGINEERING CO. (American)—English agents, if any.

ELECTRICITY SUPPLY

Accrington's Post-War Plan.

Accrington.—DEVELOPMENT SCHEME.—At its January meeting the Town Council authorised the Electricity Committee to prepare a development scheme which will be submitted to the Electricity Commissioners for approval. Sir Thomas Higham, chairman of the Electricity Committee, said it was essential that the Corporation should establish its own station and see that it was in the borough. At Nelson Square there were 7½ acres against the 4 acres covered by the present undertaking, and coal and water were near at hand. They could carry on at the present station for five or six years. Meanwhile they could prepare their plans and obtain tenders for the new works. He wanted permission to prepare plans so that the scheme could be submitted to the Central Electricity Board.

Councillor W. Howson required an assurance that the cost would not be against the interests of consumers. If they got a new station would the grid take their surplus electricity? The cost of production was going up. Would it not be cheaper to purchase outright from the grid and have in Accrington merely a distributing station?

Sir Thomas said they had to act quickly. In the autumn of 1941 the Council put forward a scheme for an extension which was turned down by the Central Electricity Board. The manager then suggested an alternative site in Nelson Square. Plans were considered by the Board, which also inspected the site, and the Board's manager promised to let them know something later.

Barrow-in-Furness.—EXTENSIONS.—The Corporation Electricity Committee has obtained sanction to borrow £4,376 for supply extensions.

Birkenhead. — ALUMINIUM UTENSILS. — Consumers who have been supplied with aluminium pans are being asked by the Electricity Committee to return any not in use to meet the present difficulties of supplying such pans with cookers.

SUBSTATION SITE.—The Electricity Committee has purchased a site for a substation.

Blackburn.—WORKS COMMITTEE TO BE ESTABLISHED.—The Electricity Committee has decided to accede to a request to establish a Joint Works Committee for the electricity undertaking. One member of the Council stated that local authorities should keep their eyes open lest an attempt was made to take control out of their hands.

Bolton.—FEED-WATER TREATMENT.—Plant for the chemical treatment of feed water at the power station is to be installed by the Electricity Committee at a cost of £3,400.

Burnley.—H.P. AGREEMENT CONCESSION.—The Electricity Committee has decided to offer special facilities to purchasers of appliances under hire-purchase agreements, who wish to buy the appliances by lump sum payments. A discount of 10 per cent. is being allowed. This concession is not to be applicable to any agreement under which full payment is due to be made within one year.

Blackburn Works Committee.

Cardiff.—NEW TRANSFORMERS.—The Electricity Committee is to purchase three 1,000-kVA transformers.

Eccles.—SUPPLY EXTENSION.—The Electricity Committee proposes to carry out a cable extension and lay a main for a supply of electricity to the Silk Street British Restaurant at a cost of £420.

Hull.—MAINS AND SERVICES.—Sanction is being sought by the Electricity Committee to borrow £5,000 for mains and services.

London. — HAMMERSMITH. — The Borough Council is recommended to approve the carrying out of repairs to a high-voltage switch and two transformers at an estimated cost of £1,800.

Manchester.—LOANS.—The Electricity Committee has obtained sanction to borrow for mains and substation equipment.

Morecambe.—SUPPLY TO FARMS.—The Electricity Committee is considering an application for the provision of a supply to two farms in the rural area.

Sheffield.—MAINS.—The Electricity Committee is to extend mains at a cost of £1,298.

Surbiton.—SEWAGE WORKS PLANT.—The Town Council is applying for permission to borrow £3,000 in connection with a scheme for the electrification of the sewage works.

Watford.—CABLE.—The Electricity Committee has purchased cable from the Southend Corporation at a cost of £1,096.

LOANS.—The Electricity Committee has obtained sanction to borrow for equipment, meters, mains and services.

TRANSPORT

Barrow-in-Furness.—FLUORESCENT LIGHTING.—Experiments are being made with fluorescent bench lighting at the transport depot, where three or four fittings are being installed by the Transport Committee at a cost of £13 each.

Russia.—NEW TUBE RAILWAY.—In a broadcast talk from Moscow last week some of the problems which were overcome in the construction of the new "Metro" line serving the Stalin factory were described. It was stated that the railway passes under the Moscow River four times and that building was in progress at the most difficult period of the war, when the Germans were very close to the capital. Boys and girls helped in the work, and the names of several who distinguished themselves were mentioned.

Salford.—INCREASED TRAM REVENUE.—The transport undertaking shows a net profit on the year of £20,321. Tram receipts were £2,979 lower and bus receipts £62,563 higher.

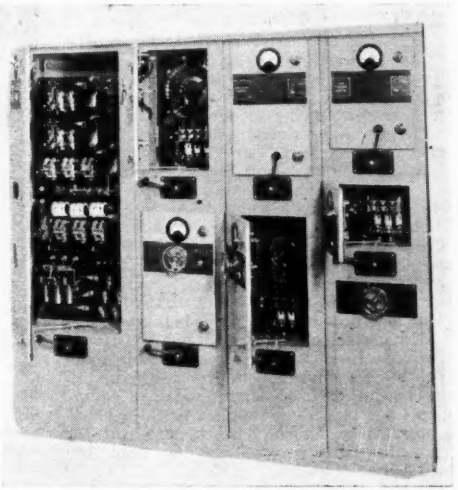
South Shields.—REVERSION TO TRAMS.—The Town Council has reintroduced the tram service along Ocean Road to the Pier Head in place of the trolley-buses in order to save fuel and rubber. The measure is only temporary.

Manufacturing Progress—II

Further Examples of Notable Orders Completed in 1942

British Thomson-Houston Co., Ltd.

LAST year the British Thomson-Houston Co., Ltd., put up a record of achievement similar to that reported of other manufacturers in our last week's issue, which of course left out of account any aspects of war work which may not be discussed at present. In the case of the B.T.H. Co. these included marine plant, magnetos and sound-film equipment. As an example of the more normal developments, the output of turbo-alternators included 30,000-kW two-cylinder sets and 20,000-kW and 15,000-kW single-cylinder sets, together with several ranging from 3,000 to 10,000 kW, all for 3,000 RPM. Others from 1,250 to 2,500 kW were combined geared sets with turbines running at 6,000 RPM. A new development has enabled balancing tests to be carried out on site. In the hydro-electric field three vertical 7,250-kVA 600-RPM and four 15,000-kVA 428-RPM water-wheel alternators have been shipped to India, for which country another order was fulfilled for electrolytic plant, which included an 800-kW DC generator driven by a 910-kVA synchronous-induction motor.



Multi-motor control board; units withdrawable at back (B.T.H.)

Three further 2,500-kW, 3,000-V steel-tank rectifiers were supplied to the South African Railways and a considerable number of units were produced for broadcasting here and abroad. Some 1,500-kW rectifiers for railway service effect the smoothing of the DC voltage without DC reactors, but with special resonant shunts. Among the numerous pumpless rectifiers completed or on order is one of the grid-controlled type for supplying a 4,000-HP rolling-mill motor. An improvement of 4 per cent. in efficiency and a reduction of light-load losses to one-seventh are claimed in comparison with a motor-generator. Included in the orders received for glass-bulb rectifiers were three of 2,000 A for the purpose of producing hydrogen by electrolysis.

Among the transformers put into service or awaiting dispatch to home or overseas undertakings are some of 60,000, 40,000 30,000 and 20,000 kVA output. Many orders have been executed for units for arc-furnaces (up to 8,600 kVA), resistance furnaces and heavy-current welding units. There has been a considerable demand for the Company's current-limiting reactors, mainly of the cast-in concrete type.

Switchgear developments at medium voltage which are proving popular include an 800-A load-breaking isolator, a 600-A switch-fuse and a 400-A air circuit-breaker, all with a rupturing capacity of 25 MVA. The last-named is also being supplied for service up to 75 MVA at 3·3 kV in truck-type gear. Low-oil-content circuit-breakers now have the oil vessels fitted with internally compensated explosion chambers for ratings up to 1,000 MVA at 11 kV and 1,500 MVA at 33 kV, and are of the pneumatically impelled type. A modification has been introduced in the 6·6- and 11-kV class, up to 250 MVA, in the form of a round-tank circuit-breaker having a single explosion chamber.

Air-blast circuit-breakers have been developed for accommodation in metalclad and cellular switchgear and for use on systems up to 33 kV with an interrupting capacity of 750 MVA. The basis for higher ratings has also been established.

A new design of earthing resistor has been

evolved employing a natural circulating system for the electrolyte which is capable of carrying earth-fault current for 30 sec. and also of reducing the amount of electrolyte required.

As an example of the large number of electrical equipments for rolling-mills under construction, there is one for driving a general purpose 21-in. three-high mill without flywheel. This comprises a 3,000-4,000-4,000-HP, 795/1,000-V DC motor making 100-134-180 RPM, which is started by means of grid-control of the associated rectifier. Many older mills have had their outputs increased by modernising their electrical equipment. A winder for South Africa incorporating a Ward-Leonard set and two 52-RPM, 3,190-HP DC motors (11,000 HP peak) was completed. Its duty is to raise 8 tons per wind nearly 6,000 ft. at 3,000 ft. per min.

A less usual order covered two 400-HP reversing motors for driving forging machines. Each motor is supplied from a flywheel motor-generator under Ward-Leonard control, the object being to eliminate the severe mechanical wear experienced with mechanical reversing clutches. For new orders contactors are replacing liquid controllers, particularly for underground winders in gold mines.

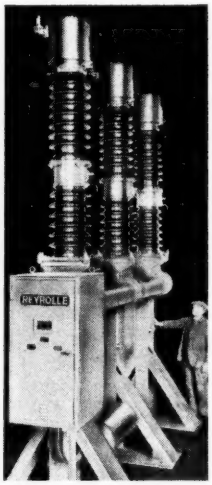
The principal control-gear developments relate to multi-motor control boards, each starting equipment being entirely separate from the others. The " Selsyn " system has been applied to the automatic control of the route and flow of material in belt conveyors and in basket elevators. Orders have been received for electrically controlled soot blowers for thirteen boilers with up to thirty heads each. A large number of equipments for providing supplies to three-phase motors from single-phase systems on the capacitor Ferreris-Arno system were put into service in 1942.

Complete lighting installations have been planned to use fluorescent lamps only and these have been found as satisfactory when used in trough reflectors forming continuous lines fixed high up as when used as supplementary lighting mounted 3 or 4 ft. above machines or benches. Considerable progress in the design of fittings is reported, mainly in the direction of eliminating site-fashioned conduit wiring, as exemplified in " Mazdalux" continuous trough reflectors.

A. Reyrolle & Co., Ltd.

THE range of small-oil-volume outdoor circuit-breakers for voltages up to 132 kV made by A. Reyrolle & Co., Ltd., has been extended and the number supplied to home and overseas markets during the past year was again substantially increased. These are of the high-speed pneumatically operated pattern, with or without auto-reclose mechanisms.

Improvements in oil-filled current transformers for outdoor open-type switchgear take the form of insulation with oil-impregnated special paper which permits a compact single-stage construction, resulting in greater accuracy and the use of less oil. Voltage transformers now have an open-ended core and each phase is in a hollow porcelain filled with oil; the insulation of the primary winding (which has one end earthed) is graded to give uniform voltage-gradient to earth with impulse as well as system voltages.



Reyrolle 66-kV, 400-A, 500-MVA pneumatically-operated small-oil-volume circuit-breaker

Large orders are in hand for high-voltage switchgear for power stations and also for smaller standard ranges, a substantial proportion of the latter emanating from abroad. Mining switchgear, especially of the pillar flameproof and air-break types, has been in heavy demand. The range of the last-named has been extended to include a 60-A flameproof motor-starting contactor panel.

High-speed ratio-balance protection and super-imposed carrier current protection have found extended scope with high-voltage overhead lines. The " Solkor " unit feeder protective system (a development of the Merz-Price system) has been applied to complex feeders (*i.e.*, those with tees or with step-up power transformers at one or both ends) and covers a feeder-transformer unit as a whole. Busbar-zone protection has been the subject of substantial orders, completed or in hand.

There has been an accelerated demand for welding equipment—principally engine-driven single-operator or two-operator (twin-generator) sets and AC-motor-driven single-operator sets, all incorporating 300-A DC welding generators. In addition a number of multi-operator welding sets have been built for the mass production of light-gauge steel components.

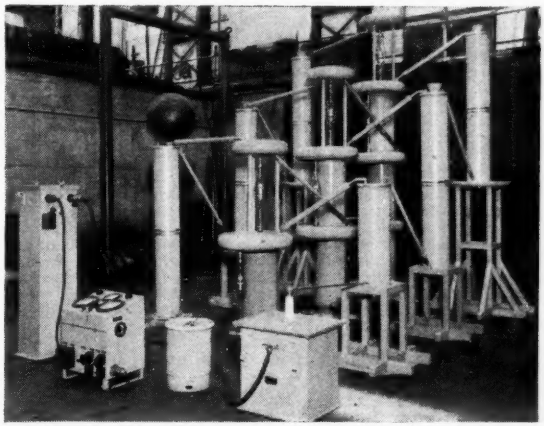
Numerous orders are in hand for generators of various sizes for coupling to engines and for AC variable-speed commutator motors,

the range of which has extended to cover from 3 to 50 HP with direct- or remote-manual or remote push-button control.

Ferranti, Ltd.

LARGE power transformers built last year by Ferranti, Ltd., included two 45,000-kVA and one 60,000-kVA, 132-kV, three-phase units and a 40,000-kVA unit, also fitted with on-load tap-change gear, which was put into service in a large power station. Work for the export market included nine banks of single-phase transformers of from 20,000 to 40,000 kVA with primary windings for 68 and 110 kV.

The "stress-control" system of protection against lightning surges has been further developed. Surges of standard wave shape and of amplitude up to 915 kV were applied to a 60,000-kVA, 132-kV transformer, the high-voltage bushing protective gaps being removed. Subsequently, in order to simulate flash-over conditions in service and to subject the transformers to a chopped surge (*e.g.*, at 4·2 micro-seconds), the standard protective gap of 26 in. was fitted. Surge amplitudes up to 915 kV compare with a standard surge strength of 645 kV specified for this class of transformer in the latest A.I.E.E. specifications.



Ferranti six-valve three stage 45-kV DC pressure testing equipment

To meet the need for equipment for installation and service tests on high-voltage cables, further developments have been made in portable DC testing equipments. To simplify transport where the highest voltages are not required, the equipment is arranged in sections of 150 kV and is furnished with push-button voltage control and facilities for measurement. More than 200 Ferranti surge absorbers have been ordered for the protection of the motors, auxiliary control and lighting installations of 1,200-HP, 3-kV locomotives for main-line service in South Africa.

A recent development which is being increasingly applied to a wide variety of manufacturing processes is the high-frequency eddy-current heating of metals, both ferrous and non-magnetic, for case-hardening, soldering, brazing and other forms of localised heat treatment. A typical example of the equipment for this purpose is a 6-kW, 300-cycle unit. Rapid local heating is obtainable by this method and the time taken by many manufacturing processes can be very considerably reduced.

A lower demand in present circumstances for large moving-coil regulators for transmission and distribution circuits has been more than offset by the greatly increased call for small automatic regulators for individual services and for the control of manufacturing processes, in particular the heat treatment of metals and electro-chemical processes. Complete cycles of treatment may be automatically controlled to pre-set conditions. A typical instance is a small air-cooled self-contained 230-V automatic moving-coil regulator, including induction-disc motor drive and astatic voltage relay covering ± 15 per cent. variations in incoming voltages between 200 and 260 without change in connections. The large numbers of regulators required have permitted the mass production of parts, resulting in greatly simplified manufacture.

A new type of direct-operation automatic temperature controller for many types of furnace, which requires no thermo-couples or delicate instruments, has been developed during the past year. In one installation a temperature of 1,550 deg. C is being automatically maintained within 10 deg. C. and even finer limits appear practicable.

Power Station Fatality Sequel

THE widow of James Morton, 32, an electrical engineer employed by Ferguson, Pailin, Ltd., claimed damages against Manchester Corporation at the Manchester Assizes last week in respect of her husband's death in an explosion at the Corporation's power station on July 7th, 1941. Liability was admitted, and Mr. Justice Stable gave judgment for the plaintiff and awarded her £2,325 and costs, the damages including an allocation to each of the two children of £250.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Turner & Newall, Ltd., for the year ended September 30th, record a trading profit of £2,407,550, which is £138,171 less than in the previous year. Depreciation absorbs £188,196 (£188,908), board fees £2,296 (£2,579) and group taxation £1,686,218 (£1,847,762), leaving a net profit of £530,840 (£506,472). Preference and ordinary dividends take £407,589 (£402,798) and, after placing £10,000 (same) to the welfare trust and £100,000 (same) to the general reserve, the carry-forward is increased by £13,251 to £78,440. The chairman states that during the current year the demand for the company's products is likely to be fully maintained, with the exception of the range of building materials, the position about which is not clear, as it depends entirely on Government policy.

Sterling Electric Holdings, Ltd., the subsidiary of Sterling Industries, reports an increase for the year to March 31st, 1942, of £9,391, as compared with £9,841 for the previous year, from which is deducted expenses and fees, leaving a profit of £4,387 (against £6,799). Provision for taxation requires £2,000, and after clearing loss on investments (£3,000) and the debit of £12,413 brought in, the debit carried forward is £13,026. The 6½ per cent. cumulative preference dividend is in arrears since October 1st, 1938.

Radio Rentals, Ltd., has declared a final dividend of 6 per cent., again making 10 per cent. for the year.

Greenwood & Batley, Ltd., have declared an interim dividend of 5 per cent., as last year.

New Companies

John F. Hall, Ltd.—Private company. Registered January 2nd. Capital, £3,150. Objects: To carry on the business of electrical, mechanical and general engineers, manufacturers of, and dealers in, tools and engineering equipment, etc. Directors: J. F. Hall, 16, Rangemoor Street, Burton-on-Trent, and P. S. Hall, 128, Eton Road, Burton-on-Trent. Registered office: 6A, Horninglow Street, Burton-on-Trent.

Stichling Electrical Equipment, Ltd.—Private company. Registered January 4th. Capital, £100. Objects : To carry on the business of manufacturers of, and dealers in, electrical apparatus, fittings and accessories, accumulators, batteries, wireless sets, etc. Directors : W. E. Stichling, 46, Parkhill Road, London, N.W.3, and P. Fisher, 44, West Kensington Court, London, W.14. Registered office : 12, Warren Court, Euston Road, London, N.W.1.

Pasta Developments, Ltd.—Private company. Registered January 2nd. Capital, £500. Objects : To carry on the business of manufacturers of, and dealers in, scientific instruments (especially instruments for the therapeutic treatment of diseases), manufacturers of, and dealers in, automatics, telemechanics and control apparatus for the treatment of diseases ; electrical engineers, manufacturers of, and dealers in, surgical appliances, etc. Directors: G. Bocking, 26, Willow Road, N.W.3, D. Edsall, 29, Christchurch Hill, N.W.3, and A. Lierneux, address not stated. Registered office : 3 and 8, Pitts Head Mews, London, W.1.

K. Lindner, Ltd.—Private company. Registered January 5th. Capital, £100. Objects: To carry on the business of heating and lighting engineers, etc. G. W. T. Coles, Standbrook House, 2-5, Old Bond Street, London, W.1. is the first director. Registered office : Standbrook House, 2-5, Old Bond Street, London, W.1.

Companies' Returns

Statements of Capital

Sphere Investment Trust, Ltd., formerly United Electric Tramways of Montevideo, Ltd.—Capital, £1,400,000 in 600,000 preference 600,000 ordinary and 200,000 unissued shares of £1 each. Return dated June 5th. All preference and ordinary shares taken up. £495,105 paid on 231,105 preference and 264,000 ordinary shares. £704,895 considered as paid on 368,895 preference and 336,000 ordinary shares. Mortgages and charges : £600,000.

Christy Brothers & Co., Ltd.—Capital, £225,000 in £75,000 preference stock and £150,000 ordinary stock. Return dated August 10th. All stock taken up. £176,083 paid. £48,917 considered as paid. Mortgages and charges : Nil.

Potteries Electrical Warehouse, Ltd.—Capital, £2,000 in £1 shares. Return dated August 7th. 1,225 shares taken up. £1,245 paid (including £20 paid on forfeited shares). Mortgages and charges : Nil.

Wood Auto-Electrical Co., Ltd.—Capital, £4,000 in £1 shares. Return dated August 11th. All shares taken up. £1,500 paid. £2,500 considered as paid. Mortgages and charges : Nil.

John Davis & Son (Derby), Ltd.—Capital, £35,000 in £1 shares (30,000 ordinary and 5,000 undenominated). Return dated July 20th (filed August 5th). 30,000 ordinary shares taken up. £15,000 paid. £15,000 considered as paid. Mortgages and charges : Nil.

Halifax & Bermudas Cable Co., Ltd.—Capital, £50,000 in 10,000 shares of £5 each. Return dated July 8th. All shares taken up. £50,000 considered as paid. Mortgages and charges : Nil.

Austinlite, Ltd.—Capital, £6,000 in 6,000 shares of £1 each. Return dated July 22nd. All shares taken up. £6,000 paid. Mortgages and charges : Nil.

Greenwood & Batley, Ltd.—Capital, £600,000 in 140,000 preference, 354,585 ordinary and 105,415 unclassified shares of £1. Return dated August 7th. 110,660 preference and

STARTERS

A full range is available, including all types, for A.C. and D.C. Motors, Hand Operated, Automatic, Air, and Oil Break.

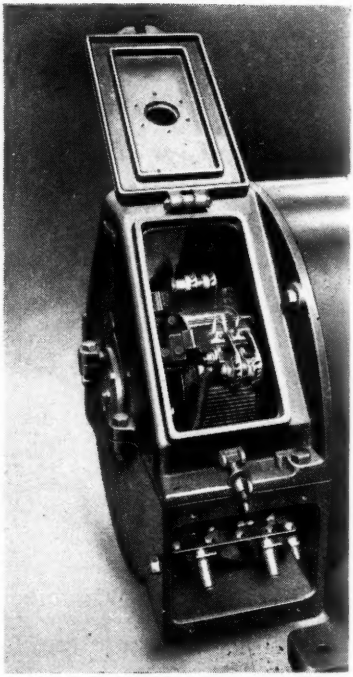
SWITCHBOARDS

Of all types, Open Flat Back Type, Enclosed, Oil Immersed Non-Drawout type, and Switchboard mounting gear.

VERITYS LTD. ASTON BIRMINGHAM 6

Sales Headquarters: BRETTENHAM HOUSE, LANCASTER PLACE, W.C.2

FOR INSPECTION



L.S.E. direct current motors are designed so that it is easy to inspect the commutator and brushgear. In this one can trace the influence of the early days of electric power, when a commutator on full load was often a thing of wild beauty but hardly a joy to the maintenance engineer. To-day, L.S.E. motors give such trouble-free service that we don't think many users would notice if we welded on the doors and covers.

We make a wide range of D.C. motors and generators for industrial and marine applications and are not afraid to claim that they are very good machines.

LAURENCE, SCOTT & ELECTROMOTORS LIMITED

SPECIALIST MAKERS OF ELECTRIC MOTORS FOR SIXTY YEARS

NORWICH, MANCHESTER L.S.E. LONDON & BRANCHES

354,715 ordinary shares (including 130 forfeited shares) taken up. £201,312 paid (£1 per share on 69,340 preference and 121,340 ordinary shares. 6s. on 14,660 preference and 10s. on 12,520 ordinary shares, leaving £26 calls unpaid. £247,515 considered as paid on 26,660 preference and 220,855 ordinary shares. Mortgages and charges : £100,000.

Domestic Electrification, Ltd. — Capital, £50,000 in £1 shares. Return dated June 3rd (filed August 1st). 40,000 shares taken up. £40,000 paid. Mortgages and charges : Nil.

Morley Electrical Engineering Co., Ltd.—Capital, £5,000 in 5,000 shares of £1 each. Return dated August 6th. All shares taken up. £3,980 paid. £1,020 considered as paid. Mortgages and charges : £1,000.

Eastern Telegraph Co., Ltd. — Capital, £7,000,000 in £5,000,000 ordinary and £2,000,000 preference stock. Return dated July 9th. All stock taken up. £7,000,000 paid. Mortgages and charges: £2,000,000.

County Electrical Co. (Pendleton), Ltd.—Capital, £2,000 in 2,000 shares of £1 each. Return dated July 31st. 1,000 shares taken up. £1,000 paid. Mortgages and charges : Nil.

Woodstock Power Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated July 7th. 3,510 shares taken up. £3,510 paid. Mortgages and charges : £7,000.

Lamp Caps, Ltd.—Capital, £50,000 in £1 shares. Return dated July 8th. All shares taken up. £50,000 paid. Mortgages and charges : Nil.

West African Telegraph Co., Ltd.—Capital, £400,000 in £10 shares. Return dated July 9th. 23,109 shares taken up. £231,090 paid. Mortgages and charges : Nil.

J. Stone & Co., Ltd.—Capital, £1,200,400 in 600,000 preference and 600,400 ordinary shares of £1. Return dated July 28th. All shares taken up. £1,200,400 considered as paid. Mortgages and charges : Nil.

Electric Cables, Ltd.—Capital, £2,000 in £1 shares. Return dated July 2nd. 1,000 shares taken up. £1,000 paid. Mortgages and charges: Nil.

Anchor Cable Co., Ltd.—Capital, £250,000 in £10 shares. Return dated July 17th. 21,334 shares taken up. £79,340 paid. £134,000 considered as paid. Mortgages and charges : Nil.

Stokes Appliances, Ltd.—Capital, £5,000 in £1 shares. Return dated August 25th. 403 shares taken up. £403 paid. Mortgages and charges : Nil.

Chapel Tramway Co., Ltd.—Capital, £12,040 in 12,040 shares of £1 each. Return dated March 26th (filed September 28th). All shares taken up. £12,040 paid. Mortgages and charges : Nil.

H. E. Keen & Co., Ltd.—Capital, £6,000 in £1 shares. Return dated September 29th. All shares taken up. £502 paid. £5,498 considered as paid. Mortgages and charges : Nil.

Walter's Electrical Manufacturing Co., Ltd.—Capital, £18,000 in £1 shares. Return dated July 7th. 16,875 shares taken up. £6,875 paid. £10,000 considered as paid. Mortgages and charges : Nil.

Mortgages and Charges

Edward Wilcox & Co., Ltd.—Further charge on land and premises at Sharston Road, Wythenshawe, Manchester, dated December 21st, 1942, to secure £4,610 13s. 4d. (which includes £3,110 13s. 4d. owing on mortgages dated November 11th, 1937). Holders : Lord Mayor, Aldermen and Citizens of the City of Manchester.

Electrical Utilities, Ltd.—Assignment on December 17th, 1942, of proceeds of contract, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Combie Electric Co., Ltd.—Debenture, charged on the company's property, present and future, including uncalled capital, dated December 18th, 1942, to secure £5,750. Holders : Davis & Soper, Ltd., 54, St. Mary Axe, London, E.C.

Receiver Released

Kamroe Radio Co., Ltd.—Walter A. Bridge, of 20, Down's Avenue, Pinner, Middlesex, ceased to act as receiver and manager on December 28th, 1942.

Liquidations

W. G. Cannon & Sons, Ltd.—Particulars of claim by January 18th to the liquidator, Mr. J. P. Southwell, 31, Budge Row, London, E.C.4.

Mansell & Ogan, Ltd.—Winding up voluntarily. Liquidator, Mr. J. D. H. Sheridan. It is stated that all creditors have been, or will be, paid in full.

Bankruptcies

F. E. Roberts and J. Savill, electricians, lately carrying on business as Commercial Light, Heat & Power Co., 47, Poland Street, London, W.1, electrical engineers and contractors.—Trustee, Mr. L. A. West, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver, released December 30th.

G. A. Weston, electrical contractor, 5-6, Roman Wall House, Crutched Friars, London, E.C.3.—Trustee, Mr. L. A. West, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver, released December 30th.

L. Dixon, electrician, 209, Hall Street, Stockport, formerly carrying on business at 165, Great Portwood Street, Stockport.—Trustee, Mr. F. H. Langmaid, 20, Byrom Street, Manchester, 3, Senior Official Receiver, released December 30th.

H. Rose (Rose Electrical Services), electrical dealer and contractor, 158, Soho Road, Handsworth, Birmingham.—Trustee, Mr. F. E. Bendall, 48-50, Exchange Buildings, New Street, Birmingham, 2, released December 11th.

H. Nutter, electrical engineer, 246, Yorkshire Street, Rochdale.—Application for discharge suspended for a period of six months until June 11th, 1943.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK EXCHANGE markets have nothing to complain about in the way of business so far as the first part of the New Year is concerned. Evidently a certain amount of money had been held up in December awaiting the turn of the year : perhaps also awaiting the trend of the coming war news. The latter offering encouragement to cheerfulness, money returned into Stock Exchange markets with vested cash to supplement it. The result has been to bring about further improvement in prices under the pressure of an incessant demand for securities. During the past few days, the index figure for Home Railway stocks has reached the best attained for nearly six years, while the industrial index this month virtually ties with the highest touched since January, 1938. These figures are significant of the weight of money that seeks employment in Stock Exchange markets. The policy of the Government in closing the way to new issues has, of course, the effect of driving more and more capital into stocks and shares already existent.

Gilt-Edged Strength

Any stocks of gilt-edged nature are in active demand. The British Government list is being sedulously searched for securities that have so far failed to participate in the rise which has occurred since the New Year started. Central Electricity stocks show gains ranging from ten to twenty shillings. London Passenger Transport 4½ per cent. "A" stock is up 2, at 120½, and the 5 per cent. "B" at 119½ is 3 points to the good. Such rises as these are a surprising result of one week's work : they indicate how keen is the acquisitive tendency of the present day. This is further exemplified by an advance of 5 points, to 116, in Southern Railway 5 per cent. preference stock.

Home Railways

The Home Railway market has not been behind other parts of the House in its upward disposition. Prices of junior stocks have spurted since the end of 1942 and in a good many cases prior-charge quotations are several points better as compared with a fortnight ago. London Passenger Transport "C" has risen 1½ to 56½ in sympathy with the advancing tendency shown by other prices in its market. The stock attracts comparatively little attention, however, speculative interest being more devoted to lower priced issues. Southern Railway 5 per cent. preferred is 2 points up at 77, at which the return on the money, allowing for inclusion in the price of 1¼ per cent. net dividend, yet to be declared, works out to £6 12s. per cent. on the money. The stock has received its full 5 per cent. annually since 1935, inclusive. The company's deferred stock dividend for 1941 was 1¾ per cent. In view of these two considerations, the 5 per cent. preferred looks a reasonably cheap investment at its current figure.

Home Electricity Supply

The ordinary shares of the Home Electricity supply undertakings now give a yield of little more than 4 per cent. except in a few cases. North Eastern Electric ordinary at 32s. 9d. pay 4¼ per cent. ; Edmundsons, at 28s. 6d., four guineas ; Northamptons, £4 3s.; and Southern Areas 4¼. Midland Electric Corporation ordinary and Electrical Distribution of Yorkshire ordinary both yield a little over 4 per cent. These shares are mentioned because in each case the market has a certain amount of supply available to meet the demand. It is difficult to obtain most of the other ordinary shares in the list. Where this is the case, the would-be purchasers will find that the best policy is to ask for the refusal of shares if any come to market.

Miscellaneous Matters

County of London Electric ordinary have recovered to 40s. 6d. and London Associated Electric ordinary to 24s. These are the only changes of any note in the list of Home electricity supply shares. Northmet 6 per cent. preference hardened to 31s. Other preference shares keep very firm and are mostly 6d. to 1s. better on the week. Palestine Electric "A" have gone back to 30s.

The recent dramatic rise in Brazilian Tractions has served to direct notice to other dollar shares. Canadian utilities were put up, Power Corporations to 7, Shawinigans to 19¾ (a rise of 1¾) and Montreal Power to 28. Even Canadian Marconis came to light, and were advanced 1s. to 6s. 6d. Communication stocks keep steady ; rises of £2 and 10s. respectively took Cable & Wireless preference to 110, the ordinary to 76½. Argentine stocks are somewhat irregular. The income debenture of Anglo-Argentine Tramways fell 2½ to 12, but rallied to 13s.

Thomas Tilling rose 1s. to 50s. 6d. upon declaration of an interim dividend of 3½ per cent. tax free by the new Tilling Motor Services.

Radio Boom

A remarkable outburst of activity in radio shares is one of the outstanding features of the industrial market. E. K. Cole 5s. shares which were 14s. 6d. a month ago, are now 23s. 6d. Electric & Musical Industries, standing at 17s. 6d. on December 15th last, have spurted to 22s. 6d. Shares in other companies dealing with similar work are being largely bought. Ultra - Electrics.

(*Continued on page* 98)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Jan. 12	Rise or Fall	Yield p.c. £	s.	d.
Home Electricity Companies							
Bournemouth and Poole	12½	12½	57/6	..	4	7	0
British Power and Light	6	6	28/–	..	4	5	9
City of London	7	7	31/6	..	4	9	0
Clyde Valley	8	8	40/6	..	3	19	0
County of London	8	8	40/6	+1/6	3	19	0
Edmundson's: 7% Pref.	7	7	33/6	..	4	3	7
Ord.	6	6	28/–	..	4	5	9
Elec. Dis. Yorkshire	9	9	43/6	..	4	3	9
Elec. Fin. and Securities	12½	12½	49/–	..	5	2	1
Elec. Supply Corporation	10	10	46/6	+6d.	4	6	0
Isle of Thanet	2	Nil	16/–	..	—		
Lancs. Light and Power	7½	7½	36/6	..	4	2	2
Llanelly Elec.	5½	5½	22/6	..	4	17	9
Lond. Assoc. Electric	4½	4	24/–	+1/6	3	6	8
London Electric	6	6	27/–	..	4	9	0
London Power Red. Deb.	5	5	104½	..	4	15	7
Metropolitan E.S.	8	8	40/6	..	3	19	0
Midland Counties	8	8	40/–	..	4	0	0
Mid. Elec. Power	9	9	43/6	..	4	4	9
Newcastle Elec.	7	7	30/–	..	4	13	5
North Eastern Elec. Ordinary	7	7	32/6	..	4	6	4
7% Pref.	7	7	33/6	..	4	3	7
Northampton	10	10	47/6	..	4	4	0
Notting Hill 6% Pref. (£10)	6	Nil	9¾	..	—		
Northmet Power: Ordinary	7	7	38/–	..	3	13	8
6% Pref.	6	6	31/–	+1/–	3	17	5
Richmond Elec.	6	6	25/–	..	—		
Scottish Power	8	8	40/–	..	4	0	0
Southern Areas	5	5	22/6	..	4	9	0
South London	7	7	26/–	..	—		
West Devon	5	5	22/6	..	4	9	0
West Glos.	4½	3½	21/6	..	3	5	2
Yorkshire Elec.	8	8	41/–	..	3	18	0
Overseas Electricity Companies							
Atlas Elec.	Nil	Nil	4/6	..	—		
Calcutta Elec.	7*	7*	31/6	..	—		
Cawnpore Elec.	10	10	27/–	..	7	8	2
East African Power	7	7	30/–	+6d.	4	13	4
Jerusalem Elec.	7	5	23/6	..	4	5	0
Kalgoorlie (10/-)	7½	5	9/6	..	5	5	3
Madras Elec.	6*	4*	22/6	..	—		
Montreal Power	1½	1½	28	+1	5	7	2
Palestine Elec. "A"	Nil	4*	30/–	–1/–	2	13	4
Perak Hydro-elec.	6	.7	9/–	..	—		
Shawinigan Power	83cts.	90cts.	19¾	+1¼	—		
Tokyo Elec. 6%	6	6	21½	..	—		
Victoria Falls Power	15	15	78/9	..	3	16	4
Whitehall Inv. Pref.	5	5	20/–	..	5	0	0

Company	Dividend Previous	Dividend Last	Middle Price Jan. 12	Rise or Fall	Yield p.c. £	s.	d.
Public Boards							
Central Electricity: 1955–60 (Civil Defence)	—	3	100	+½	3	0	0
1955–75	5	5	116	+1	4	6	2
1951–73	4½	4½	107	..	4	4	1
1963–93	3½	3½	103	+1	3	8	0
1974–94	3½	3½	99½	+½	3	5	4
London Elec. Trans. Ltd.	2½	2½	96½	..	2	11	10
London & Home Counties 1955–75	4½	4½	108	..	4	3	4
Lond. Pass. Trans.: A	4½	4½	120½	+2	3	14	8
B	5	5	119½	+3	4	3	10
C	3	2½	56½	+1½	5	1	9
West Midlands J.B.A. 1948–68	5	5	109	..	4	11	7
Telegraph and Telephone							
Anglo-Am. Tel.: Pref.	6	6	110½	..	5	8	7
Def.	1½	1½	27	..	5	11	1
Anglo-Portuguese	8	8	23/–	..	6	19	4
Cable & Wireless: 5½ Pref.	5½	5½	110	+2	5	0	0
Ord.	4	4	76½	+½	5	4	7
Canadian Marconi $1	Nil	4cts.	6/6	+1/–	2	10	0
Globe Tel. & Tel.: Ord.	8½*	5*	31/6xd	..	3	3	6
Pref.	6	6	27/6xd	+1/–	4	7	3
Great Northern Tel.: (£10)	Nil	Nil	23	..	—		
Inter. Tel. & Tel.	Nil	Nil	7	..	—		
Marconi-Marine	7½	7½	31/6	..	4	15	3
Oriental Tel. Ord.	16	10	58/–	..	3	9	0
Telephone Props.	6	Nil	13/3	..	—		
Tele. Rentals (5/–)	10	10	10/–	..	5	0	0
Traction and Transport							
Anglo Arg. Trans.: First Pref. (£5)	Nil	Nil	5/–	..	—		
4% Inc.	Nil	Nil	13	–1½	—		
Brit. Elec. Traction: Def. Ord.	45	45	1025	..	4	7	8
Pref. Ord.	8	8	170	..	4	14	2
Bristol Trams	8	10	48/–	+9d.	4	3	4
Brazil Traction	$½	$1	23½	+1½	—		
Calcutta Trams	8	5½	19/–	..	5	15	9
Cape Elec. Trams	5	5	22/6xd	..	4	9	0
Lancs Transport	10	10	43/3	..	4	12	4
Mexican Light: 1st Bonds	5	5	93½	..	5	7	0
Rio 5% Bonds	5	5	102½	..	4	17	6
Southern Rly.: 5% Prefd.	5	5	77	+2	6	9	10
5% Pref.	5	5	116	+5	4	6	1
T. Tilling	10	10	50/6	+1/–	3	19	0
West Riding	10	10	37/6	..	5	6	8

(Continued on next page)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Jan. 12	Rise or Fall	Yield p.c.
Equipment and Manufacturing					£ s. d.
Aron Elec. Ord. ..	7½	10	35/–	+1/6	5 14 4
Assoc. Elec. :					
Ord.	10	10	48/–	..	4 3 4
Pref.	8	8	39/–	..	4 2 0
AutomaticTel.&El.	12½	12½	54/–	+1/–	4 12 7
Babcock & Wilcox	11	11	48/6	..	4 10 7
British Aluminium	10	10	49/6	..	4 1 1
British Insul. Ord.	20	20	5½	+⅛	3 18 0
British Thermostat (5/–)	18½	18½	16/6	..	5 12 1
British Vac. Cleaner (5/–)	10	15	20/6	..	3 13 2
Brush Ord. (5/–)	Nil	6	6/9	..	4 12 4
Callender's ..	15	15	76/9	+9d.	3 18 0
ChlorideElec.Storage	15	15	76/3	..	3 18 9
Cole, E. K. (5/–)	7	10	23/6	+5/6	2 4 6
Consolidated Signal	17	17	95/–	..	3 11 9
Crabtree (10/–) ..	17½	17½	36/6	+6d.	4 16 0
Crompton Parkinson Ord. (5/–) ..	30	20	24/–	..	4 3 4
E.M.I. (10/–) ..	6	6	22/6	+2/3	2 2 7
Elec. Construction	10	10	40/–	..	5 0 0
Enfield Cable Ord.	12½	12½	59/–	+6d.	4 4 7
Elecl. Switchgear (10/–)	10	10	20/–	..	5 0 0
English Electric ..	10	10	45/–	..	4 9 0
Ensign Lamps(5/–)	25	25	17/6	..	7 2 10
Ericsson Tel. (5/–)	22*	20*	43/9	..	2 5 9
Ever Ready (5/–)	40	40	36/–	+6d.	5 11 1
Falk Stadelmann	7½	7½	26/–	..	5 15 5
Ferranti Pref. ..	7	7	28/9	..	4 17 5
G.E.C. :					
Pref.	6½	6½	33/3	..	3 18 4
Ord.	20	17½	86/–	..	4 1 5
Greenwood & Batley	15	15	35/–	..	8 11 6
HallTelephone(10/–)	10	12½	22/9	..	5 10 0
Henley's (5/–) ..	20	20	23/6	..	4 5 2
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	15	56/–	..	5 7 0
India Rubber Pref.	5½	5½	20/–	..	5 10 0
Intl. Combustion	32½	30	6	..	5 0 0
Johnson & Phillips	15	15	63/–	..	4 15 4
Lancashire Dynamo	20	20	76/6	..	5 4 8
Laurence,Scott(5/–)	15	12½	10/–	..	6 5 0
London Elec. Wire	7½	7½	30/–	..	5 0 0
Lucas, J.	15	15	72/6	..	4 4 0
Mather & Platt ..	10	10	47/6	+⅛	4 4 2
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	5⅛	+⅛	3 15 6
Pye Deferred (5/–)	25	25	19/6	+6d.	6 8 2
Revo (10/–) ..	20	17½	35/6	+1/–	4 18 7
Reyrolle	12½	12½	62/9	..	3 19 7
Siemens Ord. ..	7½	7½	29/3	+⅛	5 2 7
Smith, S. (1/–) ..	50	37½	8/3	..	4 12 4
Strand Elec. (5/–)	4	7½	5/6	..	6 16 4
Switchgear & Cowans (5/–) ..	15	10	12/6	..	4 0 0
T.C.C. (10/–) ..	5	5	15/–	..	3 6 8
T.C. & M... ..	10	10	47/6	+6d.	4 4 2
Telephone Mfg.(5/–)	9	9	11/–	..	4 1 10
Thorn Elec. (5/–)	20	20	19/6	..	5 2 7
Tube Investments	23¾	20	92/–	+1/–	4 7 0
Vactric (5/–) ..	Nil	Nil	8/6	..	
Vickers (10/–) ..	10	10	18/3	+3d.	5 9 7
Ward & Goldstone (5/–)	20	20	20/6	..	4 17 7
Westinghouse Brake	10	10	57/6	..	3 9 5
WalsallConduits(4/–)	55	55	41/3	..	5 6 6
West, Allen (5/–)	7½	7½	6/6	..	5 15 5

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 96)

McMichael, Cossor, Philco and Scophony are amongst those that have advanced. Pye deferred show no change since mid December. Why there should have been this violent rush to buy shares up to the prices of to-day is difficult to explain on any other ground than that of hopefulness in regard to the post-war prospects of the industry.

Equipment & Manufacturing

Whereas speculation has taken a hand in the rises amongst radio companies' shares, investment pure and simple is responsible for half-a-crown advance in British Insulated to 5⅛. Callender's rose 9d. to 76s. 9d. at which the yield on the money is £3 18s. per cent., the same as that on British Insulated. Henley's at 23s. 6d. give a return of £4 5s. per cent., but it is doubtful whether any worth-while number of shares could be bought at that price. Murex have put on 3s. 9d. rising to 106s. 3d. and shares changed hands at that figure. Arons rose 1s. 6d. to 35s. on consideration of the 5¾ per cent. yield which they afford, and Siemens hardened to 29s. 3d. Revo 10s. shares are 1s. better at 35s. 6d. Tube Investments, with 1s. gain at 92s. now pay £4 7s. per cent. Crabtree put on the pence by rising to 36s. 6d. Other shares to show improvement this week are Ever Ready, Automatic Telephones, Enfield Cable, Mather & Platt and Telegraph Construction.

Brazilian Traction

Brazilian Traction are up a further 1¼ to 23½. The rise is explained by the fact that the company is officially declared to be liable for less taxation in Brazil than previously had been assumed. This, accordingly, opens the way to expectations that the dividend will be increased. The company has been doing well for some time past. With the exchange position easier, the remittance of cash from Brazil has been simplified. A good deal of business is passing in the shares, which have regained some of their former popularity as a gambling counter. In these latter days, speculation is severely frowned upon by the powers that be, but a certain amount of it goes on in spite of every fresh restriction.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—NEW SOUTH WALES.—Sydney County Council. March 25th. 22-kV metal-clad neutral switching equipment (Spec. 610).

June 24th. Steam generating plant for Pyrmont power station, section B. (Spec. 650).

July 8th. 50,000-kW steam turbo-alternator set for Pyrmont (Spec. 651).

VICTORIA.—State Electricity Commission. March 3rd. 132- and 66-kV outdoor switchgear and accessories (Spec. 42-43/42).

April 14th. Compound-filled 22-kV switchgear with all accessories (Spec. 42-43/41).

COMMONWEALTH. — P.M.G.'s Department. February 9th. Transformers (Sch. C4006).

February 16th. Telephone parts and accessories (Sch. C.4003).

February 22nd. Induction coils (Sch. C.3990).

March 4th. Braided switchboard cable (Sch. C.4013).

Castleford. — U.D.C. January 16th. One Morrison Electricar 4-ton refuse collector. Particulars and specifications from T. E. Birtwisle, chief sanitary inspector, Town Hall. (Deposit : £1 1s.)

Leeds.—January 25th. Town Council. Maintenance repairs over a period of six months ending September 30th, 1943, for several trades, including electrician. Specification and forms of tender from R. A. H. Livett, housing director, Priestley House, Quarry Hill. A charge of 5s. per trade will be made for documents supplied.

Manchester.—January 29th. Electricity Department. Ash sluicing plant, telphers, etc. (See this issue.)

Newcastle-on-Tyne.—City Council. Electrical work at A.R P. centres. Plans by J. F. C. Solomon, city estate and property surveyor.

Wolverhampton.—January 18th. West Midlands Joint Electricity Authority. High-voltage and low-voltage cables. (January 1st.)

Orders Placed

Glasgow.—Transport Committee. Accepted. Conduit and fittings.—Rotary Engineering Co., Ltd., Simplex Electric Co.

Liverpool.—Health Committee. Accepted. Two 12 in. by 5 in. vertical electrically driven pumps at West Derby sewage disposal works (£2,110).—Pulsometer Engineering Co.

Sheffield.—Electricity Committee. Accepted. Metering equipment (£862).—Ferranti. Automatic voltage regulators (£1,057).—Metropolitan-Vickers.

South Shields. — Corporation. Accepted. Electrical accessories.—Adamson & Co.,; Sun Electrical Co. ; Walsall Conduits. V.i.r. and t.r.s. cable.—N.E. Electrical and General Supplies.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bingley.—Extension to hospital buildings for Board of Management (A. B. Clarkson, clerk to Board, 40, North Street) ; F. Atkinson, architect, Old Bank Buildings.

Birkenhead.—Nursery, Hollybank Road ; E. & C. Atkinson.

Blackpool.—Two nurseries ; borough surveyor.

Bolton. — Restaurant, Foundry Street ; borough engineer.

Works extensions ; W. Townson & Sons, Ltd.

Additions ; Thomas Ryder & Sons, Ltd.

Brighouse.—Workshop ; H. Barker, Bradford Road.

Additions to mills ; Brookfort Biscuits, Ltd., Brookfort Mills.

Bury.—Extensions to Morgate central cooking depot (£3,500) ; J. Chadwick, borough engineer, Bank Street.

Cardiff.—Two fire stations ; city engineer.

Caterham.—A.R.P. sleeping quarters, Warlingham and Timberhill ; B. R. Palmer & Co., Mitcham.

Ealing.—Additions ; Rees-Reynolds & Hunt, architects, 63, Lincoln's Inn Fields, W.C.2.

Additions, 189, Brent Crescent, for Schori Metallising Process, Ltd. ; P. T. H. Bonnick, architect, 17, Laurier Road, N.W.5.

Hull.—Eight nurseries ; city engineer.

Ilkeston.—Restaurant, Nottingham Road, ; borough engineer.

Jarrow.—Conversion of buildings ; J. Halligan, builder, Ferry Street.

Lichfield.—Reconstruction of Lido cinema ; H. Robinson, architect, Cherry Street.

Liverpool.—Garage (£4,461) ; C. J. Doyle, builder, 15, Victoria Street.

London.—BATTERSEA.—Two nurseries (£5,300) ; borough engineer.

CATFORD.—Buildings, 23-7, Hither Green Lane ; T. P. Bennett & Son.

LEWISHAM.—Mill extensions, Lampit Vale; W. Carter, Ltd.

Middlesbrough.—Central kitchens at Lower East Street School (£900) and Acklam Road North (£2,100) ; education architect.

Northampton. — Substation ; Northampton Electric Light & Power Co., Ltd.

Southall.—Canteen, Uxbridge Road ; Iron Bridge Service Depot, Ltd.

South Shields.—Workshop ; Page, Son & Bradbury, architects, King Street.

Additions to Seamen's Mission ; J. H. Morton & Son, architects, Fowler Street.

Sunderland.—Extensions to premises in Cleveland Road for C. Smyth ; Matkin & Hawkins, Barclays Bank Chambers.

Alterations and rebuilding at the Palatine Hotel ; T. R. Milburn, 17, Fawcett Street.

Stores at works of J. L. Thompson & Sons, Ltd. ; G. T. Brown, Fawcett Street.

Wallsend.—Additions to premises, High Street East ; Purdie Lumsden & Co., Ltd., builders, Newcastle-on-Tyne.

Warwickshire.—Extensions to hospital, Solihull (£10,987) ; J. R. Deacon, Ltd., builders, Lombard Street, Lichfield.

Wigan.—Extensions to Mining College ; L. Lyons, borough engineer, Municipal Buildings.

Wolverhampton. — Restaurant, Monmore Green (£1,605) ; G. W. Yates, Ltd.

Worcester.—Central kitchen, Hounds Lane School ; city engineer, 22, Bridge Street.

Worcestershire.—School, Cofton ; H. Rowe & Son, architects, 38, Foregate Street, Worcester.

York.—Additions, Wigginton Street ; J. & E. Sturge, Ltd.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2. The superseded application numbers are omitted except where specifications have been advertised in the Journal under those numbers as open to public inspection under Sec. 91 (4) *of the Patents Acts. It will be seen that the numerical arrangement formerly employed has been superseded by an alphabetical one.*

BRITISH Thomson-Houston Co., Ltd.—High-frequency electronic apparatus. 9580/41. July 27th, 1940. (550081.) Apparatus for providing narrow strips of combustible filling material for flash lamps. 10711/41. August 22nd, 1940. (550085.) Electric dynamometers. 9579/41. July 26th, 1940. (550144.) Washing machines 7944/41. June 29th, 1940. (550180.) Magnetic cores and methods of making the same. 1116/42. January 28th, 1941. (550191.)

Coleman & Appleby, Ltd., and W. V. Appleby.—Rotary barrel machines for use in electroplating, cleaning, polishing and like manufacturing operations. November 19th, 1941. (550122.)

A. H. Double and J. B. Haughton.—Electric lighting devices for use with life jackets or the like. October 25th, 1941. (550116.)

Dubilier Condenser Co. (1925), Ltd.—Electrical condensers. 13665/42. June 15th, 1940. (550130.)

Electric Construction Co., Ltd., and J. M. Boyd.—Liquid immersed electric circuit-breakers. August 23rd, 1941. (550151.)

Escher Wyss Maschinenfabriken Akt. Ges.—Extraction control devices on steam or gas turbines. 16730/41. December 24th, 1940. (550184.)

Ferranti, Ltd., and J. Seddon.—Methods of manufacturing flat coils. November 14th, 1941. (550120.)

Hazeltine Corporation. — Carrier-signal selector network. 11753/41. October 8th, 1940. (550091.)

E. P. Hill and Metropolitan-Vickers Electrical Co., Ltd.—Electric motor equipments for driving rolling mills. March 19th, 1941. (550069.)

M. B. Hughes—Hydro-extractors. December 3rd, 1941. (550124.)

Lear Avia, Inc.—Radio direction finders. 10644/40. July 27th, 1939. (550131.)

London Electric Wire Co. & Smiths, Ltd., and A. J. Sands.—Mechanism for wrapping a covering material helically on a core. November 3rd, 1941. (550163.)

Marconi's Wireless Telegraph Co., Ltd.—Electromagnetic tapered wave guide radiators. 10684/41. December 12th, 1940. (550127.) Multiplex frequency modulation systems. 7756/41. June 19th, 1940. (550193.)

Marconi's Wireless Telegraph Co., Ltd., and F. Green.—Ultra-high-frequency valve circuit arrangements. May 28th, 1940. (550067.)

D. Napier & Son, Ltd., F. R. F. Ramsay and F. H. Aldred.—High-tension terminals. June 23rd, 1941. (550178.)

Norton Grinding Wheel Co., Ltd.—Lightning arrestors. 7519/41. June 13th, 1940. (550103.) Granular material particularly for use in lightning arrestors. 9856/42. June 13th. 1940. (550129.)

Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken).—Cathode ray tubes with magnetic concentration. September 11th, 1941. (550090.) Circuit arrangements for expanding the volume range of electric oscillations. October 14th, 1941. (550094.) Electric discharge tubes and circuit arrangements therefor. June 14th, 1941. (550104.) Piezo-electric device for converting pressure variations into potential variations. November 26th, 1941. (550123.) Circuit arrangements including more particularly amplifying circuit arrangements comprising an impedance constituted by the input impedance of a low pass or band pass filter. July 29th, 1941. (550146.) Circuit arrangements comprising at least one amplifier for amplitude modulated oscillations. May 23rd, 1941. (550171.)

G. H. Scholes & Co., Ltd., G. H. Scholes and F. J. Pearce.—Double-pole electric switches. June 19th, 1941. (550108.)

W. Stern.—Means for supervising an electric lighting load. May 19th, 1941. (550135.)

Walsall Conduits, Ltd., and E. Gough.—Snap action electric switches. August 26th, 1941. (550152.)

Westinghouse Electric International Co.—Metal carbides. 4721/41. May 8th, 1940. (550133.)

A. M. Wilson—Soot blowers. July 31st, 1941. (550147.)

B. Zucker.—Insulation of electric conductors. October 7th, 1941. (550114.)